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BIRCH CREEK

Placer Mining

Draft
Cumulative

ENVIRONMENTAL IMPACT STATEMENT

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Department of the Interior
Bureau of Land Management
Alaska State Office
1988

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1988a

ENVIRONMENTAL IMPACT STATEMENT
BIRCH CREEK

Draft Cumulative (XX) Final ( )

ALASKA STATE OFFICE
ANCHORAGE, ALASKA

Lead Agency: U.S. Department of the Interior

Cooperating Agency: U.S. Army Corps of Engineers, Alaska District

Type of Action: Administrative (XX) Legislative ( )

ABSTRACT

This Draft Environmental Impact Statement assesses the cumulative impacts of placer mining on the Birch Creek watershed as required by the U.S. District Court (District of Alaska) memorandum and order dated May 14, 1987, as amended, in Civil Case A86-083. A Proposed Action and four alternatives incorporating management options ranging from emphasizing regulation under 43 CFR 3809 to a "no mining" alternative as outlined by the Court are presented. The Proposed Action was selected to evaluate BLM's surface management practices in the affected watershed. The environmental consequences of all the alternatives are analyzed and presented.

For further information about this environmental impact statement, you may contact:

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Attention: Richard Dworsky, Project Manager
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3809 (918)

MAY 02 1988

Dear Reader:

Enclosed for your review is the Draft Environmental Impact Statement (DEIS) for the Birch Creek watershed. The U.S. District Court (District of Alaska) in civil case A86-083 filed on May 14, 1987, as amended, required BLM to prepare an EIS for Birch Creek watershed, and required an evaluation of the need for an EIS on the Fortymile, Minto Flats, and Beaver Creek watersheds.

The Bureau of Land Management (BLM) manages a substantial portion of the federally-owned land in Alaska that is open to mining activity. As a cooperating agency, the U.S. Army Corps of Engineers is the federal permitting agency for work involving the placement of dredged or fill material into waters of the United States, including wetlands.

Because placer mining activity has affected the water quality of several Alaskan streams, environmental organizations in Alaska are concerned that BLM procedures are inconsistent with its responsibility under the National Environmental Policy Act of 1969 (NEPA) to incorporate environmental reviews in decision- making procedures. These organizations also raised the question whether mining has an adverse effect on subsistence activity, and whether BLM permitting procedures are consistent with the Alaska National Interest Lands Conservation Act (ANILCA).

Any person or group who has an interest in the findings of this Draft EIS may comment on it during the public comment period. The comment period begins the day the notice of filing is published in the Federal Register by the Environmental Protection Agency and ends 45 days later. Written comments may be submitted to: Richard Dworsky, Bureau of Land Management, 701 C Street, Box 13, Anchorage, Alaska 99513, by July 11, 1988 or through attendance at one of the hearings scheduled during the comment period. We will announce the times and places of the public hearings in the Federal Register and in local newspapers. Public meetings will be held in Anchorage, Fairbanks, and those rural villages in the area affected. They will comply with the requirements of Section 810 of ANILCA. You should retain this draft EIS because of the possibility that the Final EIS will be published in abbreviated form. If that occurs, you will need this document for reference.

Any change to this DEIS as a result of the public comment period will be made available for public review in the publication of the Final EIS.

I want to personally thank those of you who have contributed to and participated in the development of this Draft EIS. I hope your involvement will continue as we move forward into the formulation of the Final EIS in the coming months.

Lester K. Rosenkrance

Acting
State Director

Notice of Public Meetings and ANILCA Section 810 Subsistence Hearings

The public comment period for the Birch Creek Placer Mining Draft Cumulative Environmental Impact Statement will be from May 16 through July 11, 1988.

Public meetings for this DEIS will take comments on both the Birch Creek DEIS and the Beaver Creek DEIS and will be held at the locations below beginning at 7:00 pm. Subsistence hearings for the Birch Creek DEIS will immediately follow the public meetings.

Bureau of Land Management Anchorage District Office
6881 Abbott Loop Road
Anchorage, Alaska
June 1, 1988

Ryan Junior High School
915 Airport Way
Fairbanks, Alaska
June 2, 1988

Tribal Hall
Beaver Village, Alaska
June 13, 1988

Cultural Center
Fort Yukon, Alaska
June 14, 1988

Community Office
Birch Creek Village, Alaska
June 20, 1988

Central School
Central, Alaska
June 21, 1988

Written comments will be accepted at the address below through July 11, 1988:

Birch Creek EIS
c/o Richard Dworsky
Bureau of Land Management
701 C Street
Box 13
Anchorage, Alaska 99513

Summary

Introduction

Sandhill Crane

A United States District Court for the District of Alaska Memorandum and Order (A86-083 Civil) filed on May 14, 1987, instructed the Bureau of Land Management (BLM) to cease approving Plans of Operations for federal placer mines after October 1, 1987, in the Birch Creek watershed, pending completion of an adequate cumulative effects Environmental Impact Statement (EIS). On May 28, 1987, additional injunctions followed covering the watersheds of Beaver Creek, the Fortymile River, and Minto Flats (which is comprised of the Chatanika River, Tolovana River, and Goldstream Creek). On July 22, 1987, the Court issued an amendment to the May 14 and May 28 orders, extending the date of cessation to the November 15, 1987. The term "lawsuit" hereafter refers to the above orders and injunctions.

This draft EIS analyzes the cumulative impacts of placer mining on the Birch Creek watershed, as directed by the District Court in the lawsuit.

There are two primary objectives of this EIS. The first is to identify and consider performance standards under which placer mining may be conducted on federal lands in the area. The second is to comply with the Court Orders and to conduct evaluations and prepare the associated documents under the National Environmental Policy Act (NEPA) and subsistence requirements found in Section 810 of the Alaska National Interest Lands Conservation Act (ANILCA).

At issue are the cumulative impacts of multiple mining operations on the environment. Initially under these injunctions, only Plans of Operations on federal claims were affected. Mines operating under Notices (operations disturbing five acres or less) were not affected; however, the impacts of such mines must be included in the evaluations. A subsequent court order of November 6, 1987, requires Plans of Operation for all operations regardless of size, or land withdrawn from mineral entries, with a one-year exception for those mines operating in 1987.

This EIS will be the overarching environmental document from which more site-specific environmental assessments can be tiered. Tiering is an interrelationship in which reference from a more general NEPA document such as this EIS can be made to a more specific one, thus avoiding duplication. A more specific environmental assessment will not change or modify decisions resulting from this analysis, but will, on a case-by-case basis, identify more detailed and site specific actions and mitigation measures to reduce environmental impacts.

The figure below illustrates some of the different guidelines and responsibilities of BLM, other federal agencies, and the State of Alaska in managing placer mining on the public lands.

BLM manages mining under the General Mining Law of 1872, 30 U.S.C. 22 et seq., as amended, and the Federal Land Policy and Management Act (FLPMA) of 1976, 43 U.S.C. 1701 et seq. The 1872 Mining Law provides for the exploration, development, production, and purchase of mineral resources of the public lands, as well as the implied right of statutory access to mining claims.

The Birch Creek drainage is located approximately 70 miles northeast of Fairbanks and encompasses nearly 1.4 million acres of land. Most of the upper portion of the drainage lies within the Steese National Conservation Area. This EIS focuses on that part of the watershed drained by Birch Creek Wild River and its upstream tributaries within the National Conservation Area. A map entitled "Area Map" depicting major features, one entitled "Status" showing land status, and the "Tributaries and Main Physical Features Map" showing topography can be found in Chapter One.

As required by NEPA regulations, BLM used an open process to gather public input. To this end, a Notice of Intent to prepare environmental impact statements was published in the Federal Register on August 18, 1987, and in local newspapers in late August 1987. BLM also conducted a series of public, or "scoping" meetings in locations throughout the affected area between July and September 1987. At the same time, more than 450 notices of the public meetings were sent out to miners, environmentalists, native groups, and other members of the public.

The BLM also invited participation from other government agencies, private organizations, the placer mining industry, and any other concerned individuals. At the scoping meetings a description of the EIS process and the proposed activity was provided by the appropriate BLM District Managers. The meetings were then opened to members of the public to voice their concerns and ask any questions about the issues.

Significant issues include:

- What are the impacts of placer mining operations on water quality?
- How are water quality standards regulated and enforced, and who performs this function?
- What are the impacts of placer mining on terrestrial habitats?
- Have reclamation practices and improved management under the 43 CFR 3809 regulations occurred since 1981?
- What are the impacts of other agency laws and regulations on the placer mining industry?
- What are the impacts of placer mining on subsistence activities ongoing in the region?

Specific coordination meetings were held with various State of Alaska agencies including the Department of Natural Resources, Department of Environmental Conservation (ADEC), Department of Fish and Game, and the Office of Management and Budget, Office of the Governor. Meetings were also held with the federal Environmental Protection Agency (EPA), U.S. Army Corps of Engineers (COE), the National Park Service, and the U.S. Fish and Wildlife Service.

After the public comment period following the release of this document, a management decision will be made which incorporates and addresses the comments. This management decision will be included in the Record of Decision and responses to the comments will be addressed in the Final EIS.

Summary of Alternatives and Environmental Consequences

Under all of the land management alternatives described in this EIS, BLM would manage lands under its authority to meet requirements found at 43 CFR 3809 (surface management regulations). Regulations of the COE are found at 33 CFR 320 et seq. The descriptions for each alternative will evaluate the cumulative impacts under various administrative conditions and requirements of not only the BLM but also that of the State of Alaska, EPA, and the COE.

Proposed Action

The Proposed Action for this EIS is to continue management of mining claims on federal lands as it was conducted during the summer of 1987. Mining activities under the Proposed Action would be similar to the activity that occurred during the 1987 mining season. BLM would manage placer mining in the Birch Creek drainage according to State of Alaska water quality standards with EPA variances. Reclamation activities would reshape tailings to approximate the surrounding physiography and spread the overburden and available topsoil over the reshaped tailings. Settling ponds would be similarly reclaimed. The stream bypass would be stabilized or reinforced to make it the permanent channel. The reclaimed site would be allowed to revegetate naturally.

The water quality performance standards would be the current EPA effluent guidelines and ADEC water quality standards, or the existing EPA/ADEC variance for the operation. The performance standards are 0.2 ml/l of settleable solids and 5 Nephelometric Turbidity Units (NTU) above natural conditions when natural turbidity is 50 NTU or less, and not more than a 10% increase in the turbidity when the natural turbidity is 50 NTU, not to exceed a maximum increase of 25 NTU at the mine effluent discharge point.

Consequences

Under the Proposed action, BLM reasonably foresees that a total of 80 mines (48 federal and 32 State and private mines) would be operating continuously for the next ten years.

There should be no significant cumulative impacts on topography or mineral resources. The soil profile would be completely altered by mining operations on approximately 1,840 acres of ground.

Water quality would not be significantly affected and water quality would return to approximately natural conditions after successful stabilization of the disturbed area and stream channel. There would be short- to long-term increases in suspended sediments and turbidity, and accelerated local erosion resulting in a possible increase in sediment (1,852 tons per day) introduced into the stream bypass in the vicinity of the disturbed area. The impact on chemical water quality is not known.

The vegetation cover would be destroyed in the areas of the mines and roads resulting in an unavoidable short-term loss of productivity. Approximately 347 acres would regrow to a riparian tall shrub community within 30 years of reclamation, and an additional 600 acres would regrow within 50 years on mining disturbance in creek bottoms. One thousand three hundred fifty four acres of new mining disturbance would remain barren or sparsely vegetated. This acreage would be an irretrievable and irreversible loss of vegetation resources.

There are no "listed" or "candidate" threatened or endangered plant species within the watershed. Mining and associated activities would have no known direct effect under the proposed action or any of the alternatives upon the one endemic sensitive the plant species involved *Poa porsildii.*

Approximately 6,258 acres of wildlife habitat would be physically altered due to mining and related activities. Periodic disturbances to wildlife due to the operation of vehicles and machinery and human habitation affecting 223,000 acres could result in a low to moderate level of short-term cumulative effects. The principal long-term adverse effect of mining would be the unavoidable loss of approximately 947 acres of moose winter habitat range in Crooked Creek, Harrison Creek, and the headwaters of Birch Creek for a 30 to 50-year period. This long- term cumulative loss of habitat to mining activities in these areas would probably contribute to a minimal reduction in moose population potential.

There are five to eight known peregrine falcon breeding pairs in the watershed. Protective measures would be required for any mining activity within one mile of these nests. No anticipated activities are within one mile of any known nest areas.

Physical alteration of 20 miles of streams (12 miles due to federal claims, eight on State/private) and increases in suspended sediment from 80 mines in the basin will result in adverse cumulative effects on the aquatic resources. The clear flowing headwater reaches of streams that are blocked to fish passage would also be unavailable as habitat to some fish populations in the affected area. The overall cumulative adverse effect of total suspended sediment and turbidity increases in Birch Creek cannot be determined.

Cumulative impacts on cultural and paleontological resources in the Birch Creek drainage do not appear to be significant.

Much of the Birch Creek drainage downstream from mining is used by residents villages and communities in the region for subsistence purposes. Such traditional subsistence activities include hunting, fishing, and trapping. Residents of Birch Creek village also use the river for drinking water and as a transportation route to various resource harvest areas. By 1987 certain subsistence activities and resources in the lower Birch Creek drainage are reported by residents to have been significantly impacted by poor water quality and sedimentation. These effects may be largely due to past and current upriver mining.

The analysis provided in this EIS indicates that while mining in 1987 on federal lands was not a cause for largely pre-1987 impact, neither will it be a remedy, as certain sedimentation will remain in downstream areas traditionally used by Birch Creek village residents for subsistence purposes thus continuing the cumulative impacts on the area. This analysis was seen as applicable to all other alternatives, with differences among them only involving how quickly a reversal might occur to this ongoing condition of significant restriction to subsistence uses.

Motorized recreational activities would be enhanced due to the increased access provided by additional mining roads. Increased mining activity would detract from the semi-primitive experiences in drainages north of Birch Creek. Visitor use of the Wild River corridor is expected to continue at near 1987 levels.

Visual resources may be reduced slightly in the immediate area by additional roads. Meeting water quality standards would improve the perception of a wild and natural landscape by river recreationalists and others.

If the number of mines increased from 65 to 80 (23%) over the next decade, it is reasonable to assume that mining expenditures, total output, mining employment, total employment, mining income, and total income would also increase by about 23%. Annual costs for all federal mining operations would be $249,600 for water treatment and $96,000 for reclamation. Administration and enforcement of the Surface Mining program for placer mining would cost the BLM about $86,400 (all values are in 1987 dollars).

Alternative A

This alternative would regulate mining under BLM Surface Management regulations (43 CFR 3809). The water quality performance standards would be the current EPA/ADEC standard of 0.2 ml/l of settleable solids and 5 NTU turbidity when measured 500 feet below the mine discharge point. No water quality variances would be incorporated in this alternative. Soils and stream channels would be stabilized, and restoration and revegetation would be allowed to proceed by natural processes.

Consequences

The effects of Alternative A are based on 70 mines (42 federal and 28 State and private mines) operating continuously for the next ten years.

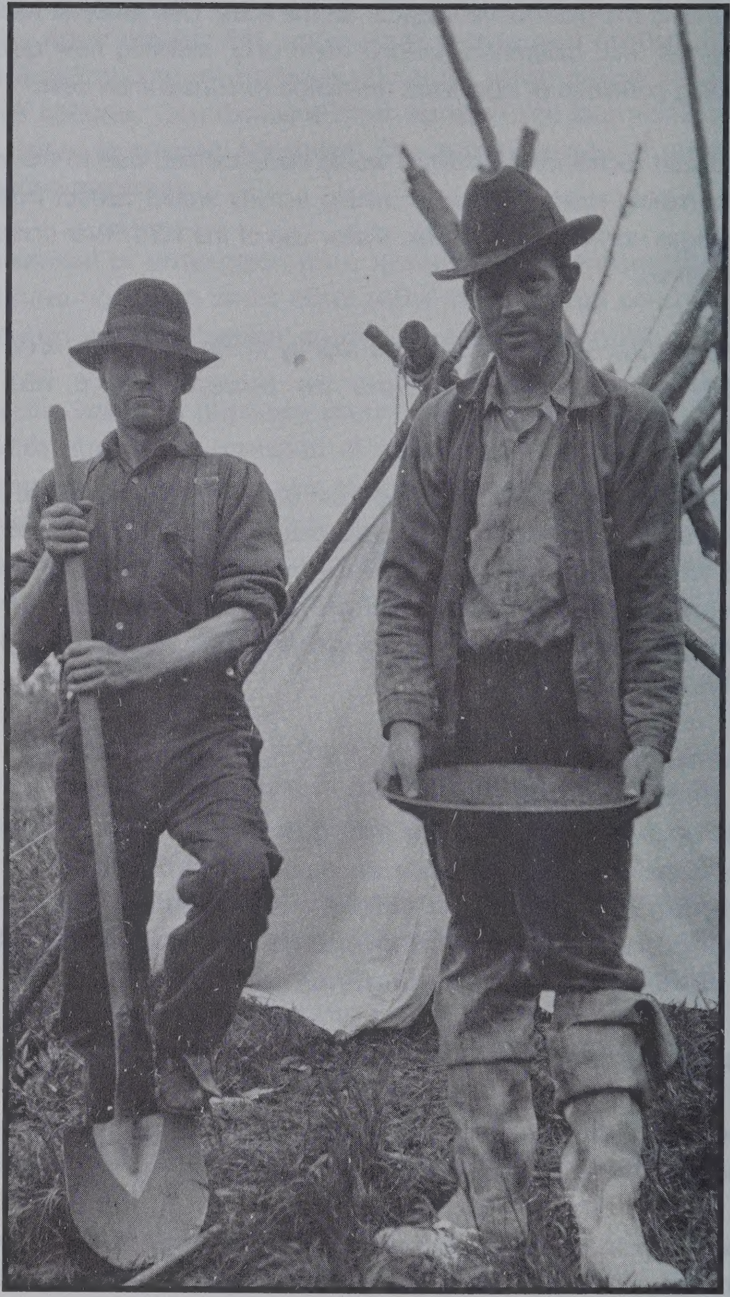
There should be no significant cumulative impacts on topography or mineral resources. The soil profile would be completely altered by mining operations on approximately 1,610 acres of ground.

Water quality would not be significantly affected and water quality would return to approximately natural conditions after successful stabilization of the disturbed area and stream channel. There would be short- to long-term increases in suspended sediments and turbidity, and accelerated local erosion resulting in a possible increase in sediment (1,671 tons per day) introduced into the stream system in the vicinity of the disturbed area. The impact on chemical water quality is not known.

The vegetation cover would be destroyed in the areas of the mines and roads resulting in an unavoidable short-term loss of productivity. Two hundred acres would regrow to a riparian tall shrub community within 30 years of reclamation, and an additional 580 acres would regrow within

50 years on mining disturbance in creek bottoms. One thousand two hundred and eighty eight acres of new mining disturbance would remain sparsely vegetated. This acreage would be an irretrievable and irreversible loss on vegetation resources.

Approximately 5,855 acres of wildlife habitat would be physically altered due to mining and related activities. Periodic disturbances to wildlife due to the operation of vehicles and machinery and human habitation affecting 193,500 acres could result in a low to moderate level of short-term effects. The principal long-term adverse effect of mining would be the unavoidable loss of approximately 782 acres of moose winter habitat range in Crooked Creek, Harrison Creek, and the headwaters of Birch Creek for a 30 to 50-year period. This long- term cumulative loss of habitat to mining activities in these areas would probably contribute to a minimal reduction in moose population potential.



Alaska placer miners circa 1928 or 1929. Photo courtesy of the Anchorage Museum of History and Art.

Physical alteration of 17.5 miles of streams (10.5 miles due to federal claims, seven on State/private) and increases in suspended sediment from 70 mines in the basin will result in adverse cumulative effects on the aquatic resources. The clear flowing headwater reaches of streams that are blocked to fish passage would also be unavailable as habitat to some fish populations in the affected area. The overall cumulative adverse effect of total suspended increases in Birch Creek cannot be determined.

Cumulative impacts to cultural resources in the Birch Creek drainage do not appear to be significant.

Impacts to recreation from mining and associated access would be greater than current levels, but less than the Proposed Action. Motorized recreational activities would be enhanced due to increased access provided by additional mining roads. Visitor use of the Wild River corridor would likely increase with the improved water quality in the mainstem of Birch Creek.

Visual resources would be reduced slightly in the immediate area by additional roads. Meeting water quality standards would improve the perception of a wild and natural landscape by river recreationalists and others.

If the total number of mines increased from 65 to 70 (8%) over the next decade, it is reasonable to assume that mining expenditures, total output, mining employment, total employment, mining income, and total income would also increase by 8%.

Annual costs for all federal mining operations in the Birch Creek drainage would be $1,533,000 for water treatment and $42,000 for reclamation. Administration and enforcement of the Surface Mining program for placer mining would cost the BLM about $58,800 (all values are in 1987 dollars).

Alternative B

This alternative would combine the standards from 43 CFR 3809 with standards established to meet the management goals of the various Resource Management Plans for the watershed.

Water quality performance standards would be defined by current EPA/ADEC regulations as 0.2 ml/l settleable solids and 5 NTU turbidity when measured 500 feet below the mine discharge point. Stabilization of soils and creek channels would be constructed so that natural recovery and revegetation processes would be enhanced.

Consequences

The effects of Alternative B are based on 70 mines (42 federal and 28 State and private mines) operating continuously for the next ten years.

There should be no significant cumulative impacts on topography or mineral resources. The soil profile would be completely altered by mining operations on approximately 1,610 acres of ground.

Water quality would not be significantly affected and water quality would return to approximately natural conditions after successful stabilization of the disturbed area and stream channel. There would be short- to long-term increases in suspended sediments and turbidity, and accelerated local erosion resulting in a possible increase in sediment (1,671 tons per day) introduced into the stream bypass in the vicinity of the disturbed area. The impact on chemical water quality is not known.

The vegetation cover would be destroyed in the areas of the mines and roads resulting in an unavoidable short-term loss of productivity. Three hundred and four acres would regrow to a riparian tall shrub community within 30 years of reclamation, and an additional 507 acres would regrow within 50 years on mining disturbance in creek bottoms. One thousand one hundred and eighty five acres of new mining disturbance would remain barren or sparsely vegetated. This acreage would be an irretrievable and irreversible loss on vegetation resources.

Approximately 5,855 acres of wildlife habitat would be physically altered due to mining and related activities. Periodic disturbances to wildlife due to the operation of vehicles and machinery and human habitation affecting 193,500 acres could result in a low to moderate level of short-term effects. The principal long-term adverse effect of mining would be the unavoidable loss of approximately 886 acres of moose winter habitat range in Crooked Creek, Harrison Creek, and the headwaters of Birch Creek for a 30 to 50-year period. This long- term cumulative loss of habitat to mining activities in these areas would probably contribute to a minimal reduction in moose population potential.

Physical alteration of 17.5 miles of streams (10.5 miles due to federal claims, eight on State/private) and increases in suspended sediment from 70 mines in the basin will result in adverse cumulative effects on the aquatic resources. The clear flowing headwater reaches of streams that are blocked to fish passage would also be unavailable as habitat to some fish populations in the affected area. The overall cumulative adverse effect of total suspended sediments and turbidity increases in Birch Creek cannot be determined.

Motorized recreational activities would be enhanced due to increased access provided by additional mining roads. Visitor use of the Wild River corridor would likely increase with the improved water quality in the mainstem of Birch Creek.

Visual resources could be reduced slightly in the immediate area by additional roads. Meeting water quality standards would improve the perception of a wild and natural landscape by river recreationalists and others.

If the total number of mines increased from 65 to 70 (8%) over the next decade, it is reasonable to assume that mining expenditures, total output, mining employment, total employment, mining income, and total income would also increase by about 8%.

Annual costs for all federal mining operations would be $1,533,000 for water treatment and $84,000 for reclamation. Administrative and enforcement costs to the BLM would be approximately $92,400 (all values in 1987 dollars).

Alternative C

This alternative would focus on various standards or procedures proposed or under discussion by the EPA and the COE. The water quality performance standards for this alternative would be zero ml/l settleable solids and zero NTU turbidity above natural conditions. Reclamation standards would emphasize restoration of naturally appearing contours, creek channels, and native vegetation. Mining activities would be conducted to minimize impacts to wetlands and riparian zones.

Consequences

The effects of Alternative C are based on 58 mines (35 federal and 28 State and private mines) operating continuously for the next ten years.

There should be no significant cumulative impacts on topography or mineral resources. The soil profile would be completely altered by mining operations on approximately 1,334 acres of ground.

Water quality would not be significantly affected and water quality would return to approximately natural conditions after successful stabilization of the disturbed area and stream channel. There would be short- to long-term increases in suspended sediment and turbidity, and accelerated local erosion resulting in a possible increase in sediment (1,475 tons per day) introduced into the stream bypass in the vicinity of the disturbed area. The impact on chemical water quality is not known.

The vegetation cover would be destroyed in the areas of the mines and roads resulting in an unavoidable short-term loss of productivity. Three hundred and eight acres would regrow to a riparian tall shrub community within 30 years of reclamation, and an additional 709 acres would regrow within 50 years on mining disturbance in creek bottoms. Seven hundred and eighty two acres of new mining disturbance would remain barren or sparsely vegetated. This acreage would be an irretrievable and irreversible loss on vegetation resources.

Approximately 5,391 acres of wildlife habitat would be physically altered due to mining and related activities. Periodic disturbances to wildlife due to the operation of vehicles and machinery, and human habitation affecting 162,108 acres could result in a low to moderate level of short-term effects. The principal long-term adverse effect of mining would be the unavoidable loss of approximately 1,012 acres of moose winter habitat range in Crooked Creek, Harrison Creek, and the headwaters of Birch Creek for a 30 to 50-year period. This long- term cumulative loss of habitat to mining activities in these areas would probably contribute to a minimal reduction in moose population potential.

Physical alteration of 14.5 miles of streams (8.75 miles due to federal claims, 5.75 State/private) and increases in suspended sediment from 58 mines in the basin will result in adverse cumulative effects on the aquatic resources. The clear flowing headwater reaches of streams that are blocked to fish passage would also be unavailable as habitat to some fish populations in the affected area. The overall cumulative adverse effect of total suspended sediment and turbidity increases in Birch Creek cannot be determined.

Motorized recreational activities would be enhanced due to increased access provided by additional mining roads. Visitor use of the Wild River corridor would likely increase with the improved water quality in the mainstem of Birch Creek.

Visual resources could be reduced slightly in the immediate area by additional roads. Meeting water quality standards would improve the perception of a wild and natural landscape by river recreationalists and others.

The total number of mines is projected to decrease from 65 to 58 (11%) over the next decade. If so, mining expenditures, total output, mining employment, total employment, mining income, and total income would also decrease by about 11%. Annual costs for all federal mining operations would be $1,645,000 for water treatment and $119,000 for reclamation. Administrative and enforcement costs to the BLM and the COE would be approximately $91,400 (all values in 1987 dollars).

Alternative D

This is the "no mining" alternative defined by the District Court in its Memorandum and Order of May 28, 1987, as amended. Under this alternative, no applications for mining claims, under either Plans of Operations or Notices, would be processed or approved by the BLM. Validity examinations would be conducted for each properly recorded federal mining claim, and the owner would be compensated accordingly. Stabilization of surface disturbance which has occurred since January 1, 1981, would be required on all federal claims and restoration would be allowed to proceed by natural processes.

This action violates current regulations (43 CFR 2091.1 for accepting applications and 43 CFR 3809.1-6 for processing applications) and would therefore require changes in the regulations for legal implementation.

Consequences

The effects of Alternative D are based on 32 State and private mines operating continuously for the next ten years. There would be no further placer mining on federal claims.

Water quality would not be significantly altered and would return to near natural conditions after cessation of mining and natural stabilization of disturbed areas and stream channels. Sediment from State and private mining operations is expected to contribute 1,188 tons per day to the Birch Creek drainage.

The vegetation cover destroyed on areas previously mined would result in an unavoidable long-term loss of over 4,000 acres of vegetation resources in the area from historic mines and roads. Activity on State and private lands would result in 92 acres of tall shrub community regrowing within 30 to 50 years, and an additional 516 acres regrown to shrub in 50 years. Five hundred and eighty eight acres would remain barren or sparsely vegetated from this mining.

Approximately 4,834 acres of moose winter range would remain physically altered because of past mining related activities in Crooked Creek, Harrison Creek, and the headwaters of Birch Creek.

Continued mining on State and private lands would result in the physical alteration of 736 acres. Periodic disturbances to wildlife due to the operation of mining vehicles, machinery, and human habitation at State and private mines would result in 144,122 acres subject to short-term adverse effects in localized areas during the mining season.

The principal long-term effect of past federal mining would be the unavoidable loss of approximately 609 acres of moose range for 40 to 50 years. Additional habitat losses due to State and private mining (147 acres) would require approximately 50 years

to become suitable for wildlife use. The long-term cumulative loss of habitat to mining activities in these areas would probably contribute to a low to moderate reduction in moose population potential.

Physical alteration of 8 miles of streams (zero miles due to federal claims, eight on State/private) and increases in suspended sediments from 32 mines in the basin will result in adverse cumulative effects on the aquatic resources. The clear flowing headwater reaches of streams that are blocked to fish passage would also be unavailable as habitat to some fish populations in the affected area. The overall cumulative adverse effect of total suspended sediment and turbidity increases in Birch Creek attributable to State and private mining cannot be determined.

Cumulative impacts on cultural resources in the Birch Creek drainage do not appear to be significant.

As described under the Proposed Action, certain subsistence activities and resources would continue to be significantly restricted even if no mining were to occur on federal lands, or even if no mining mining occurred at all in the entire drainage, due to ongoing impacts from past mining. However, this alternative would not add further to the ongoing significant restriction already occurring in the area.

Some recreation impacts would continue due to reclamation activities on federal claims and continued mining on State and private lands. Visitor use would increase slightly over Proposed Action levels, but would probably remain lower than the current level of use.

Visual impacts to the land would be reduced due to lower levels of mining activity and reclamation of post-1981 disturbances on federal claims.

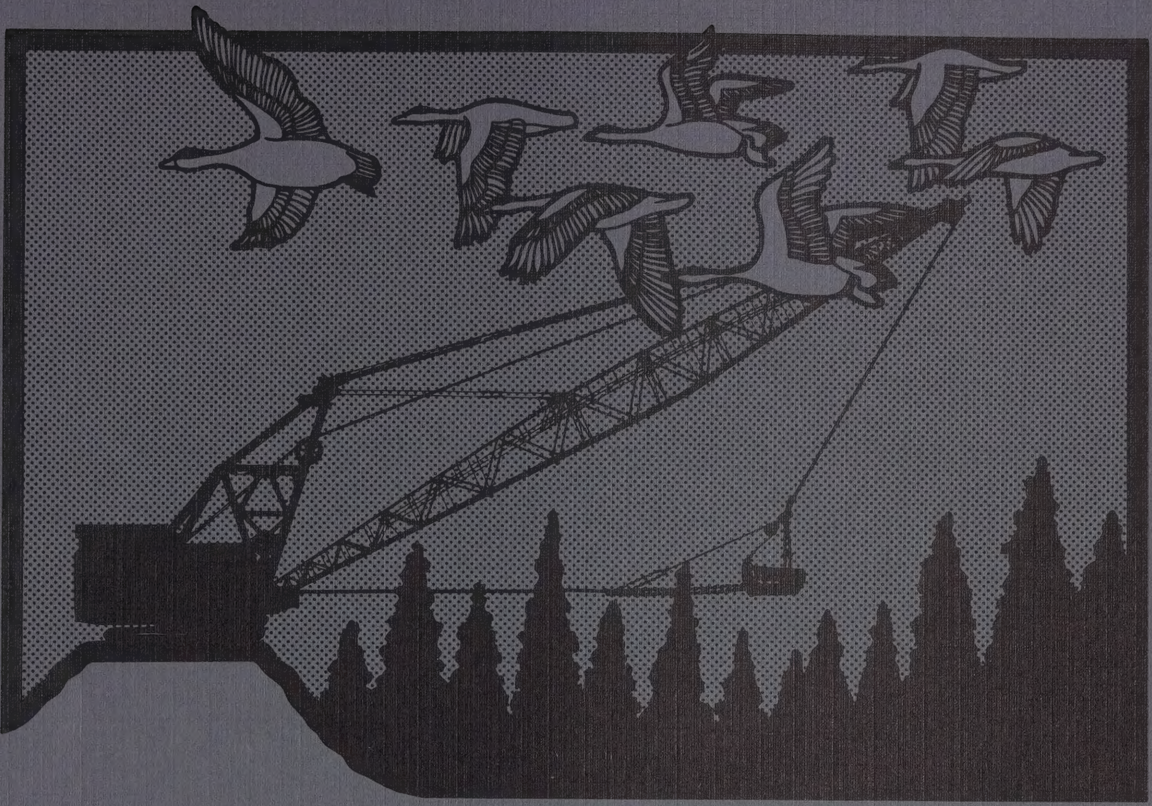
The total number of mines within the watershed would decrease from 65 to 32 (51%) over the next decade. Mining expenditures, total output, mining employment, total employment, mining income, and total income would also decrease by about 51%.

Under the no-mining alternative, the federal Government would be required to provide compensation for condemning valid federal mining claims. The present net value of the claims is roughly estimated to be between $16.2 million and $452 million. Validity examinations on all properly recorded federal mining claims would cost the BLM approximately $2.7 million to complete (all values in 1987 dollars).

BIRCH CREEK

DRAFT
CUMULATIVE
Environmental Impact Statement

Chapter I Purpose and Need For Action
Chapter II Description of Alternatives
Chapter III Affected Environment
Chapter IV Environmental Consequences
Chapter V Public Participation
Appendix
Bibliography
Glossary
Acronyms



BIRCH CREEK

Chapter I
Purpose and Need for Action

Section

Page

1.1 Purpose and Need........1 – 1
1.2 Introduction........1 – 1
1.3 Background........1 – 3
1.4 Geographic Setting and Land Status........1 – 4
1.5 Scoping and Major Issues........1 – 4
1.6 Relationship to BLM Policies, Plans, and Programs........1 – 5
1.7 Relationship to Non–BLM Policies, Plans, and Programs........1 – 7
1.8 Applicable Laws and Regulations........1 – 8
1.9 Cooperating Agency........1 – 8

CHAPTER MAPS

Area Map
Status Map
Tributaries and Main Physical Features Map

1.1 Purpose and Need

There are two primary objectives of this Environmental Impact Statement (EIS). The first is to identify and consider performance standards under which placer mining may be conducted on federal lands in the area, including methods and procedures which will be utilized "...when an activity is being accomplished by a prudent operator in usual, customary, and proficient operations of similar character and taking into consideration the effects of operations on other resources and land uses, including those resources and uses outside the area of operations" (43 CFR 3809.0-5(k)). Figure 1-1 identifies the directives from the various court orders and injunctions pertaining to this placer mining EIS, and the products of the EIS process which respond to these directives. The second objective is to comply with the Court Orders (described in Section 1.2) to conduct evaluations and prepare the associated documents under the National Environmental Policy Act (NEPA) and the Alaska National Interest Lands Conservation Act (ANILCA) subsistence requirements (ANILCA Section 810).

COURT DIRECTIVES	EIS PRODUCTS
1. Identify the degree of environmental harm (and benefits-added by team).	• Assess cumulative impacts • Consultant studies - e.g. water, fish, and wildlife • Chapter 4
2. Identify the extent that environmental harm can be prevented.	• Identification of alternative actions identified in Chapter 2 and evaluated in Chapter 4 • Record of decision • Management under 3809 program model • EA consultant contract
3. Identify the expense of preventing some or all of the harm.	• Economic study • Chapters 2 and 4 and the Appendix
4. Identify the economic and social benefits and costs of the matter being evaluated.	• Economic study • Subsistence evaluation • Chapter 4
5. Assess cumulative environmental impacts of water quality and subsistence.	• Consultant studies including water quality, fish, and aquatic habitats, visual study and subsistence • Chapters 2 and 4

Figure 1-1. Directives of the District Court Memorandum and the products of the EIS in response.

1.2 Introduction

A United States District Court for the District of Alaska Memorandum and Order (A86-083 Civil) filed on May 14, 1987, instructed the Bureau of Land Management (BLM) to cease approving Plans of Operations for federal placer mines in the Birch Creek watershed after October 1, 1987, pending completion of an adequate cumulative effects Environmental Impact Statement (EIS). On May 28, 1987, injunctions followed which covered the watersheds of Birch Creek, Beaver Creek, the Fortymile River, and Minto Flats (which is comprised of the Chatanika River, Tolovana River, and Goldstream Creek). On July 22, 1987, the Court issued an amendment to the May 14 and May 28 orders, extending the date of cessation to November 15, 1987. The term "lawsuit" hereafter refers to the above orders and injunctions.

At issue for BLM are the impacts of multiple mining operations on the environment, including the cumulative impacts, especially on water quality, visual, and subsistence resources. Initially, under these injunctions, only Plans of Operation on federal claims were affected. For the COE, the principle issues involve avoiding or minimizing impacts to waters and wetlands. Mines operating under Notices (those disturbing five acres or less) were not affected; however, the impacts of such mines are included in this EIS. A subsequent court order of November 6, 1987, requires Plans of Operations for all operations on claims with valid existing rights, regardless of size, on land withdrawn from mineral entry, with a one-year exception for mines which operated in 1987.

An EIS describes, for public review and consideration, a proposed federal action that could significantly affect the human environment. In this case, the Court felt that cumulative environmental impacts for all placer mining, on State and private, as well as federal lands, should be addressed, rather than the current practice of completing an environmental review of individual mining Plans of Operation.

This EIS is based on the National Environmental Policy Act of 1969 (NEPA) and Council on Environmental Quality (CEQ) regulations. Per CEQ regulations, the BLM used an interdisciplinary team in a systematic approach to analyze the affected area, to estimate the environmental effects, and to write this statement. Where data gaps appeared, the BLM used contract services to collect and analyze additional information. The contractors included the State of Alaska and private consulting firms. A list of the consultant contracts is included in Appendix A-1. A list of the EIS preparers is included in Chapter Five.

This EIS is in itself not a decision document, to change the land use classifications established in prior planning documents. However, if the decision is made in the Record of Decision (ROD) to modify existing land use classifications, then plan amendments would be developed. The ROD will, however, define the overarching terms and conditions under which placer mining may be conducted.

The regulations in 43 CFR 3809.2-1 require preparation of at least an Environmental Assessment (EA) for the approval of a placer mine Plan of Operations. These EA's will tier off this EIS. Tiering is an interrelationship in which reference to a more general NEPA document such as this EIS can be made in a more specific one, thus avoiding duplication. No Plans of Operations will be approved based solely on this EIS. Also, a more specific environmental assessment will not change or modify decisions resulting from this analysis, but will, on a case-by-case basis, identify more detailed and site-specific actions and mitigation measures to reduce environmental impacts. Tiering can also be used by other agencies, such as the U.S. Army Corps of Engineers (COE). The COE may use this EIS as a generalized document for reviewing work in the watershed under the Alaska COE regulatory program relative to Section 404 of the Clean Water Act.

During 1987, approximately 65 mines were active in the Birch Creek drainage. However, additional mining operations on the federal, State, and private mining estate are anticipated within the next ten years. This document analyzes the cumulative impacts of these anticipated future mining activities.

1.3 Background

BLM manages mining under the General Mining Law of 1872, 30 U.S.C. 22 et seq, as amended, and the Federal Land Policy and Management Act (FLPMA) of 1976, 43 U.S.C. 1701, et seq. The 1872 Mining Law provides for the exploration, development, production, and purchase of mineral resources on public lands, as well as the implied or statutory right of access to mining claims.

FLPMA provides that, in managing the public lands, the Secretary of Interior shall take any action required to prevent "unnecessary and undue" degradation of the land. This FLPMA provision is implemented by the Code of Federal Regulations (CFR) section covering surface management (43 CFR 3809). Additionally, specific terms and conditions for placer mining and other land uses are defined in the Steese National Conservation Area Resource Management Plan (RMP), and under the Birch Creek Wild River Management Plan.

The Clean Water Act, Section 404, applies to work involving the placement of dredged and/or fill material into waters of the United States, including wetlands. Regulations of Section 404 for the COE are at 33 CFR 320 et seq. Procedures for implementing NEPA for COE are at 33 CFR 230 and 325.

The crux of the present concern is the nature, degree, and extent of the cumulative impacts of mining and related activities on the physical, biological, and socio-economic environment in the four watersheds the Court identified. In particular, the cumulative effects and impacts of placer mining need to be clearly explained and fully analyzed. The CEQ regulations at 40 CFR 1508.7 define cumulative impacts as "the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time."

Because of uncertainty surrounding the number of mines that may operate in the reasonably foreseeable future, a methodology was established by forecasting the price of gold in the future and the number of mines that BLM might expect to operate in the next ten years. Additionally, although it is believed to be highly unlikely, a worst-case scenario was developed and analyzed.

This EIS will focus on the portions of the Birch Creek watershed shown on the Status Map in this chapter.

1.4 Geographic Setting and Land Status

The Birch Creek watershed is located approximately 70 miles northeast of Fairbanks and encompasses nearly 1.4 million acres of land. The majority of the watershed lies within the Steese National Conservation Area in the Yukon - Tanana Upland physiographic province, an area of Interior Alaska which consists of rounded hills around a high central area of rugged mountains (Selkregg 1974). The province is bounded on the north by the Yukon River and on the south by the Tanana River. An "Area Map" depicting major features, one entitled "Status" showing land status, and the "Tributaries and Main Physical Features Map" showing topography can be found in this chapter.

Birch Creek itself is formed at the confluence of Bates and Ptarmigan Creeks near Porcupine and Mastodon Domes. Other major tributaries include Crooked, Porcupine, Deadwood, Harrison Creeks, and Harrison Fork. The approximate length of Birch Creek is 344 miles from its headwaters to its mouth at the Yukon River west of Fort Yukon.

The climate of the Birch Creek area is typical of Interior Alaska with cold, dry winters and warm, but short summers. The mean January temperature for Central, in the northeast portion of the study area, is -20° F. and the mean July temperature is about 70° F., although temperatures can dip as low as -60° F. some winters and reach as high as 90° F. some summers. Precipitation averages a scant ten inches per year, which includes 60 inches of snow. The BLM lands are managed in accordance with the provisions of the Wild River Management Plan for Birch Creek, a Wild River of the National Wild and Scenic River System, and by the RMP for the Steese National Conservation Area.

1.5 Scoping and Major Issues

As required by NEPA regulations, BLM used an open process to gather public input. Initially, this was accomplished by conducting a series of public meetings in locations throughout the affected area in September and October 1987.

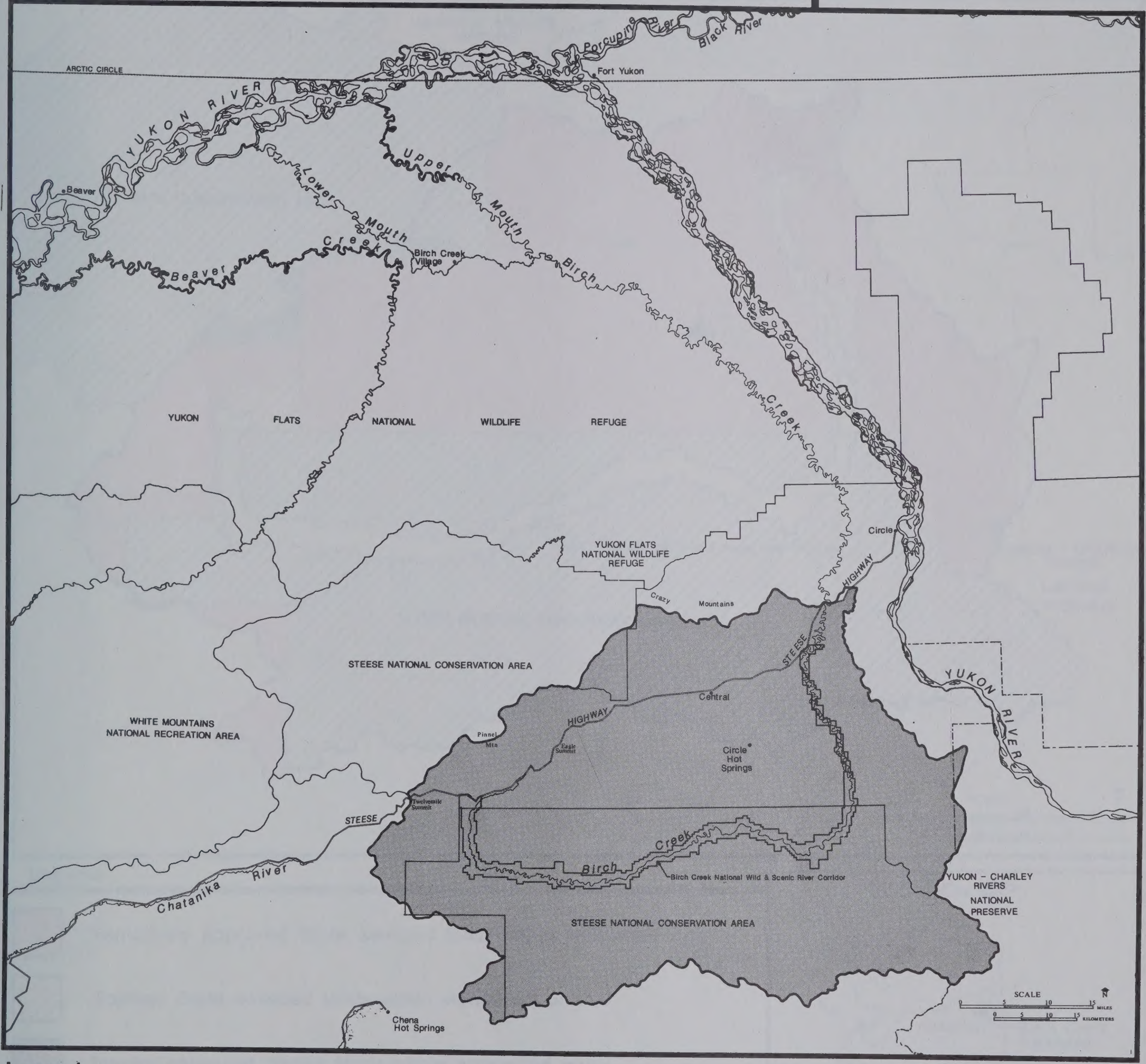
The Notice of Intent to prepare the environmental impact statements was published in the Federal Register on August 18, 1987, and in local newspapers in late August 1987.

Scoping meetings were held between September 9, and October 6, 1987, at Livengood, Minto, Central, Chicken, Birch Creek Village, Fairbanks, and Anchorage, Alaska. At the same time, more than 450 notices of the public meetings were sent out to miners, environmentalists, native groups, and other interested publics.

The BLM also invited participation from other government groups, private organizations, the placer mining industry, and concerned individuals. At the scoping meetings a description of the EIS process and the proposed activity was provided by the appropriate BLM District Managers. The meetings were then opened to members of the public to voice their concerns and to ask any ques-

Birch Creek Placer Mining
DRAFT
Cumulative Environmental Impact Statement

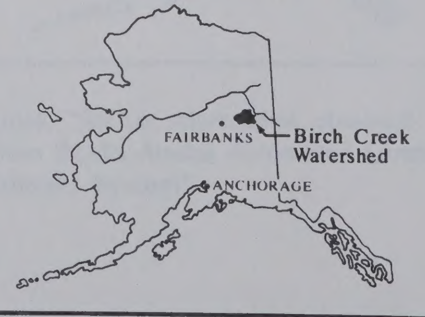
Area Map


Porcupine River
Black River
ARCTIC CIRCLE
Fort Yukon
YUKON RIVER
Beaver
Lower Mouth
Upper Mouth
Beaver Creek
Birch Creek Village
Birch Creek
YUKON FLATS NATIONAL WILDLIFE REFUGE
YUKON FLATS NATIONAL WILDLIFE REFUGE
Circle
HIGHWAY
Crazy Mountains
STEESE NATIONAL CONSERVATION AREA
STEESE
Central
HIGHWAY
Pinnell Mtn
Eagle Summit
Circle Hot Springs
WHITE MOUNTAINS NATIONAL RECREATION AREA
Twelvemile Summit
STEESE
Birch Creek
Birch Creek National Wild & Scenic River Corridor
YUKON RIVER
YUKON - CHARLEY RIVERS NATIONAL PRESERVE
Chatanika River
STEESE NATIONAL CONSERVATION AREA
Chena Hot Springs
SCALE
0 5 10 15 MILES
0 5 10 15 KILOMETERS
N

Legend

▨ Birch Creek Watershed

LOCATION MAP

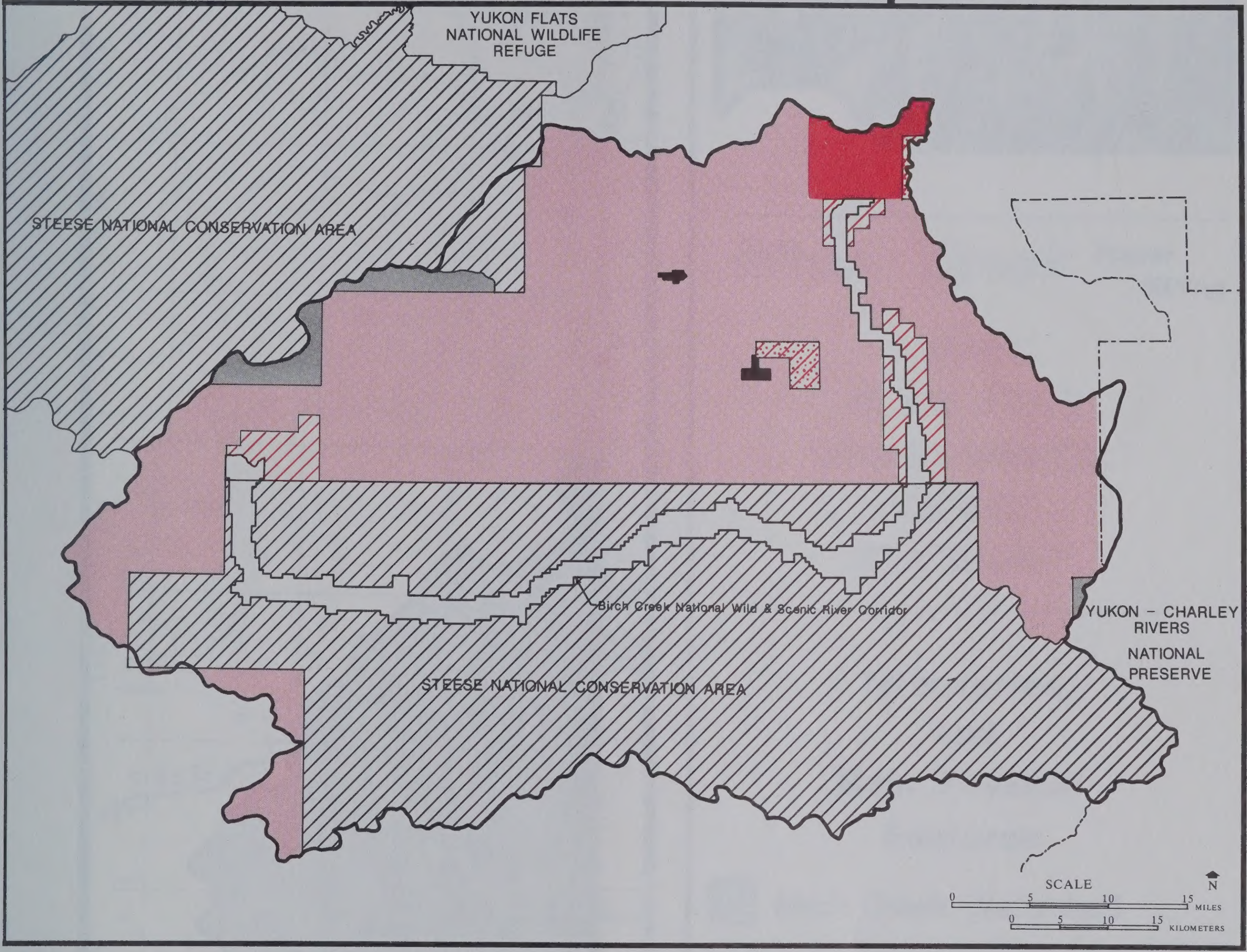

FAIRBANKS
Birch Creek Watershed
ANCHORAGE

Birch Creek **Placer Mining**

DRAFT

Cumulative Environmental Impact Statement

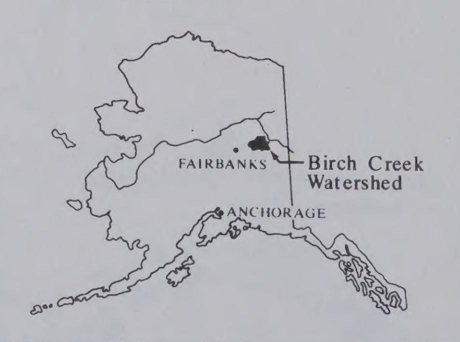
Status


YUKON FLATS NATIONAL WILDLIFE REFUGE
STEESE NATIONAL CONSERVATION AREA
Birch Creek National Wild & Scenic River Corridor
STEESE NATIONAL CONSERVATION AREA
YUKON - CHARLEY RIVERS NATIONAL PRESERVE
SCALE
0 5 10 15 MILES
0 5 10 15 KILOMETERS
N

Legend

🟪	Tentatively approved State selected lands-within watershed only
▨	Topfiled State selected lands-within watershed only
🟥	Interim conveyed Native lands-within watershed only
░	Native selected lands-within watershed only
▒	Unselected public lands-within watershed only
■	Private lands-within watershed only
▨	Steese National Conservation Area

LOCATION MAP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Birch Creek Watershed
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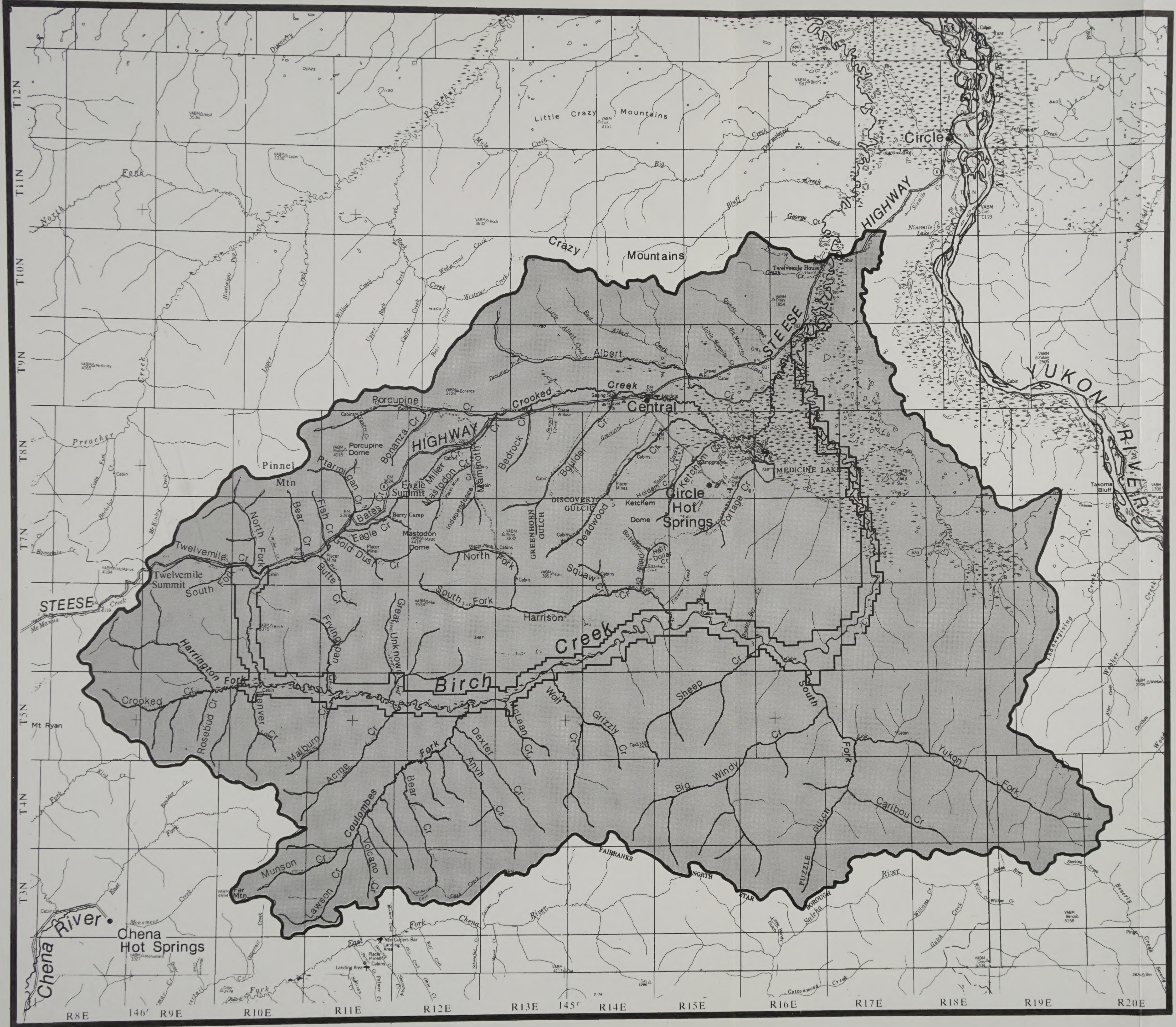
Note: "Status information obtained from BLM's Alaska Automated Lands Record System".


Little Crazy Mountains
Crazy Mountains
Circle
HIGHWAY
STEESE
YUKON RIVER
Twelvemile House
Albert Creek
Crooked Creek
Central
Porcupine Cr
Porcupine Dome
HIGHWAY
Bonanza Cr
Ptarmigan Cr
Pinnel Mtn
Eagle Summit
Mastodon Cr
Miller Cr
Mammoth Cr
Bedrock Cr
Boulder Cr
Independence Cr
Mastodon Dome
Berry Camp
Bates Cr
Eagle Cr
Gold Dust Cr
Bear Cr
Fish Cr
North Fork
Twelvemile Cr
Twelvemile Summit
South Fork
STEESE
Butte Cr
Fryingpan Cr
Great Unknown Cr
North Fork
South Fork
DISCOVERY GULCH
GREENHORN GULCH
Deadwood Cr
Ketchem Cr
Ketchem Dome
Circle Hot Springs
Portage Cr
MEDICINE LAKE
Holdem Gulch
Half Dollar Cr
Squaw Cr
Harrison Creek
Birch Creek
Harrington Fork
Crooked Cr
Rosebud Cr
Denver Cr
Malburn Cr
Wolf Cr
Grizzly Cr
McLean Cr
Dexter Cr
Anvil Cr
Sheep Cr
South Fork
Big Windy Cr
Yukon Fork
Caribou Cr
PUZZLE GULCH
Acme Cr
Coutlombes
Bear Cr
Volcano Cr
Munson Cr
Lawson Cr
Far Mtn
FAIRBANKS NORTH STAR BOROUGH
Chena River
Chena Hot Springs
Mt Ryan
Preacher Cr
Takoma Bluff
Medicine Lake
T12N
T11N
T10N
T9N
T8N
T7N
T5N
T4N
T3N
R8E
146°
R9E
R10E
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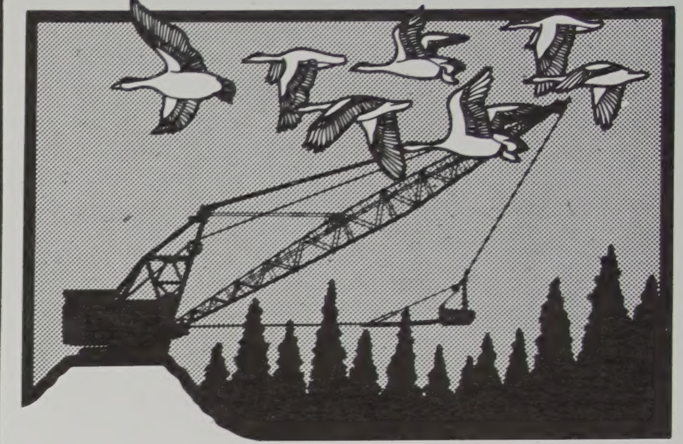
R20E

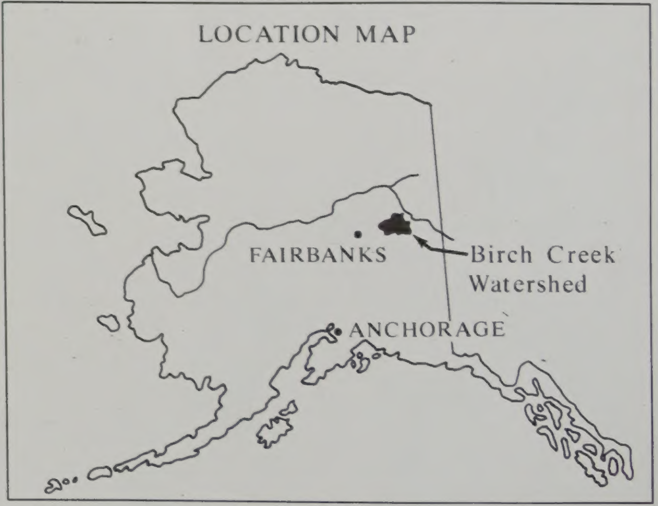


Birch Creek Placer Mining

DRAFT CUMULATIVE ENVIRONMENTAL IMPACT STATEMENT

Tributaries and Main Physical Features

▨ Birch Creek Watershed


LOCATION MAP
FAIRBANKS
Birch Creek Watershed
ANCHORAGE

SCALE
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0 5 10 15 KILOMETERS
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tions about the issues. All comments were recorded on tape. Members of the public wishing to submit written comments on scoping and issues were requested to do so before October 20, 1987. All written and oral presentations were considered and incorporated into a list of significant issues.

Significant issues include:

- **What are the impacts of placer mining operations on water quality?**
- **How are water quality standards regulated and enforced and who performs this function?**
- **What are the impacts of placer mining on terrestrial habitats?**
- **What are the impacts of placer mining on subsistence?**
- **Have reclamation practices and improved management under the 43 CFR 3809 regulations occurred since 1981?**
- **What are the impacts of other agency laws and regulations on the placer mining industry?**

Specific coordination meetings were held with various State of Alaska agencies such as the Department of Natural Resources (ADNR), Department of Environmental Conservation (ADEC), Department of Fish and Game (ADF&G), and the Office of Management and Budget, Office of the Governor. Meetings were also held with the federal Environmental Protection Agency (EPA), U.S. Army Corps of Engineers (COE), the National Park Service (NPS), and the U.S. Fish and Wildlife Service (USFWS).

By December 1, 1987, more than 32 written responses were received. Chapter Five, Consultation and Coordination, identifies the contacts, participation, and coordination more fully.

1.6 Relationship to BLM Policies, Plans and Programs

Management on BLM lands is guided by existing laws, established planning documents, and programmatic and regulatory guidelines.

For the Birch Creek EIS this includes:

- The Birch Creek River Management Plan - 1983
- The Steese National Conservation Areas (SNCA) Resource Management Plan and Environmental Impact Statement - 1986
- Surface Management of Public Lands Under the U.S. Mining Laws, 43 CFR 3809 - 1980
- Surface Management - BLM Alaska State Handbook Supplement - 1986
- Alaska National Interest Lands Conservation Act (ANILCA), P.L. 96-487 (94 Stat. 237), Dec. 2, 1980
- Federal Land Policy and Management Act (FLPMA), 43 U.S.C. 1707, et seq. - 1976
- Other regulations found in the Code of Federal Regulations.

The above plans, laws, and policies identify the general standards under which placer mining may take place in the Birch Creek drainage. Among other considerations, ANILCA closed the area for further new placer claim staking under the 1872 Mining Law, while recognizing valid existing rights. The Wild and Scenic River Corridor is closed to all new mineral entry or leasing.

The overall management strategy for the Steese National Conservation Area is to improve the water quality of Birch Creek National Wild River (NWR), to protect present and historical caribou habitat, and to provide opportunities for multiple use of natural resources while maintaining the environmental quality. The actions proposed by this EIS are compatible with the RMP goals. Where necessary, specific stipulations may be attached to mining Plans of Operations to meet the goals.

Congress, in FLPMA, 43 USC 1732(b), provided that "in managing the public lands the Secretary shall, by regulation or otherwise, take any action necessary to prevent unnecessary or undue degradation of the lands."

The regulations in 43 CFR 3809.0-5(k) define "undue or unnecessary degradation" as "surface disturbance greater than what would normally result when an activity is being accomplished by a prudent operator in usual, customary, and proficient operations of a similar character...." Failure to initiate and complete reasonable reclamation may, and failure to comply with applicable environmental statutes will, constitute unnecessary or undue degradation. The BLM has recognized this by making compliance with these laws a specific requirement for any mining operation (43 CFR 3809.2-2).

The principal federal regulatory device to ensure water quality is the Clean Water Act, 33 USC 1251, et seq. However, water quality and its associated environmental problems are extensively regulated by other statutes (Section 1.8) which BLM does not administer. COE regulates placement of dredged and/or fill material in waters and wetlands under Section 404 of the Clean Water Act.

Water pollution control is specifically regulated and permitted on the federal level by the EPA and the COE (33 USC 1311, 1342, 1344), and by the State of Alaska (A.S. 46.030.50). Water quality standards are established and certified by the State (33 USC 1313, 1341). Other agency permits are summarized in Section 1.7.

BLM would continue to review and authorize individual Plans of Operation for placer mining under 43 CFR 3809 and the Alaska 3809 Handbook, as well as other applicable laws and regulations. BLM land use plan amendments may be needed if it appears that any land use classification needs to be changed.

Figure 1-2 illustrates some of the different guidelines and responsibilities of BLM, other federal agencies, and the State of Alaska in managing placer mining on the public lands. The following section more fully describes the roles of other agencies.

Agency	Legal Guidelines & Plans for Management	Responsibility of Agency	Enforcement Responsibility of Agency
BLM	Resource Management Plan 43 CFR 3809 regulations	Surface management	Due and neccessary mining action
EPA	Section 401 of Clean Water Act	Water quality	Water standards
COE	Section 404 of Clean Water Act	Dredge and fill in waters and wetlands	Terms and conditions of COE permits
State of Alaska	Clean Water Act State regulations	Water quality Anadromous fish	State standards

Figure 1-2. General responsibilities of applicable agencies concerning placer mining. This table applies to State, federal and private mines. BLM evaluates the cumulative impacts of all mines, but can only manage within its jurisidiction.

1.7 Relationship to Non-BLM Policies, Plans and Programs

Approval of a Plan of Operation is contingent on the operator meeting all other applicable State and federal laws and regulations. These include appropriate water quality standards promulgated by EPA and Alaska DEC. Plan approvals require that the operator receive authorization of work subject to Section 404 (Clean Water Act) from the COE, Alaska District.

> "Where the BLM has evidence of suspected noncompliance with the State or federal water quality laws and regulations, the appropriate office of the EPA and/or DEC will be notified. The EPA and/or DEC have the responsibility for enforcement of the Federal Water Pollution Control Act and applicable regulations" (DOI 1986c).

The COE has jurisdiction over placing dredged or fill material in wetlands and waterways, construction or any structure in or over navigable and tidally influence waters, excavation of material from these waters, or any obstruction or alteration in such waters. Appendix F discusses the responsibilities and regulatory program of COE in more detail.

Section 10 of the Rivers and Harbors Act of 1899 requires permits for any construction or activity that alters the courses, current, condition or navigable capacity of a "navigable water" as defined by COE.

Section 404 of the Clean Water Act requires permits for placing dredged or fill material in all waters, including wetlands.

This EIS evaluates standards of various agencies in the alternatives. While BLM cannot implement other agency standards, it can assess the cumulative impacts of these standards. In the case of the COE and EPA the standards are under discussion and this evaluation is not meant to suggest these are the final agency recommendations.

Additionally, the BLM will coordinate with other agency plans. Plans of agencies with adjacent land holdings include:

- Alaska Interagency Fire Management Plan Upper Yukon, Fortymile River, BLM - 1984
- The Tanana Basin Area Plan for State Lands, State of Alaska - June 1985
- Yukon Flats National Wildlife Refuge Final Comprehensive Plan - October 1987
- Fairbanks North Star Borough Comprehensive Land Use Plan - 1988

After review of these plans, the BLM finds no inconsistencies between its management direction and the other plan recommendations.

1.8 Applicable Laws and Regulations

BLM and COE must comply with a multitude of other laws, regulations, and Federal Executive Orders such as the Alaska National Interest Lands Conservation Act, the Wild and Scenic Rivers Act, 1968; Federal Water Quality Requirements (Clean Water Act, Federal Water Pollution Control Act, Safe Drinking Water Act), the Coastal Zone Management Act of 1972, federal air quality requirements (Clean Air Act), federal solid waste requirements (Solid Waste in Disposal Act, Resource Recovery Act), endangered and threatened wildlife and plants (Endangered Species Act), Archaeological Resources Protection Act of 1979, preservation of antiquities (Antiquities Act), historic and prehistoric resources (National Historic Preservation Act, Executive Order 11593), Areas of Critical Environmental Concern [FLPMA Section 202 (c) 3], Flood Plains (Executive Order 11988 and FLPMA), Wetlands (E.O. 11990 and 11988), Prime Farm Land, Wilderness, and the National Environmental Policy Act. Additionally, placer miners may have to obtain numerous permits and approvals from federal and State agencies in order to mine (Appendix A-2).

1.9 Cooperating Agency

The U.S. Army Corps of Engineers is a cooperating agency on this EIS. To the extent possible, this EIS would provide NEPA documentation that can be incorporated into future authorization of work by the COE.

As a cooperating agency, the COE assisted BLM in scoping processes and in reviewing the development of this draft Environmental Impact Statement. The review and comments pertain to COE areas of jurisdiction and authority, i.e., flood control, navigation, and regulatory functions. Members of the COE staff have contributed consultation and document review throughout the preparation of the EISs to ensure that the procedural and statutory requirements of the COE are satisfied.

The COE's permit program regulates development of the nation's waters and wetlands through its public interest review process. Within the Birch Creek watershed, the COE has jurisdiction over work subject to Section 404 of the Clean Water Act, i.e., the placement of dredged and/or fill material into waters of the United States, including wetlands, stockpiling overburden and placer-bearing deposits, construction of stream diversions, roads and foundation pads, reclamation and similar works. Issuance of a COE permit is required for work proposed on State and private as well as federal mining operations. See Appendix F for a description of the COE Regulatory Program.

BIRCH CREEK

Chapter II
Description of Alternatives

Section Page

2.1 Introduction....2 – 1
2.2 Development of the Alternatives....2 – 1
2.3 Description of the Alternatives....2 – 2
2.4 Alternatives Considered, but Eliminated from Further Analysis....2 – 13
2.5 Summary of Environmental Consequences of the Alternatives....2 – 14

2.1 Introduction

The National Environmental Policy Act (NEPA) and the corresponding Council on Environmental Quality (CEQ) regulations require development of alternatives for a proposed action. This Proposed Action and the alternatives to it are the base for the comparative analysis of environmental consequences of an action. The purpose of the alternatives is to provide a range of management options for the final decision about the Proposed Action. See Figure 2-7 at the end of this chapter for a comparison of pre-1981 impacts with those of the 1987 mining season, and projected 1998 impacts under the Proposed Action and the alternatives.

2.2 Development of the Alternatives

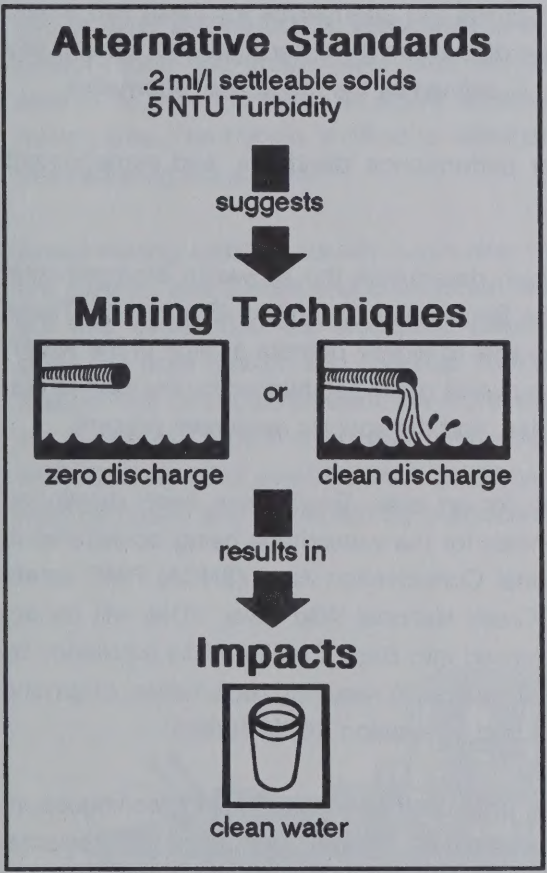


Figure 2-1. Relationship of standards, mining techniques, and impacts.

The alternatives have been designed to address the two major objectives of the study (Section 1.1): 1) consider performance standards under which placer mining may be conducted on federal lands in the area, and 2) comply with court orders to conduct a cumulative impact environmental analysis for the Birch Creek watershed and prepare the corresponding documents.

Additionally, issues and concerns raised by the public and other agencies during the scoping process were carefully considered and incorporated into the final alternatives where appropriate. Public comments from scoping are summarized in Chapter Five.

An initial set of alternatives was published in the Notice of Intent for the preparation of this and the three other placer mining EISs (DOI 1987a). These alternatives provided a basis for discussion with interested public groups, individuals, and other agencies during the scoping period. After scoping by interested public groups and other agencies, the alternatives were finalized (Section 2.3). These alternatives are the framework for the analysis of the environmental effects and the cumulative impacts of these effects. Action scenarios were developed for the standards outlined in each alternative. These are mining techniques that could be used to meet the performance standards. Environmental impacts were analyzed from these mining techniques (Figure 2-1).

2.3 Description of the Alternatives

Alternatives for this study are based on a range of performance standards. For BLM, the standards are based on the jurisdiction BLM has within the 43 CFR 3809 regulations and the relevant RMP, River Plan, other plans, and mandates of the court injunctions. Other standards used to evaluate cumulative impacts lie within the regulatory and enforcement authority of other State and federal agencies.

The 43 CFR 3809 regulations are general, and allow some interpretation in two main areas: 1) the application of the definition of undue and unnecessary degradation to the environment and specific operations and 2) reclamation of surface disturbance. For simplicity, BLM defines placer mining activities that are not customary and prudent as "undue and unnecessary."

Performance standards are used to form the spectrum of the EIS alternatives for these two areas. One alternative addresses performance standards under discussion by other agencies, specifically EPA and COE. Alternative D, the "no mining" alternative, is defined as the "no action" alternative.

As used in this document, these are the definitions for performance standards, and management goals and mining techniques:

A **performance standard** is a measurable quantity which determines the allowable environmental impacts resulting from mining and related activities in the Birch Creek watershed (Figure 2-1). These standards set maximum or minimum limits that must be met to legally operate a mine in the watershed. The standards for the watershed are based on the overall goals established by the Steese National Conservation Area RMP, the River Management Plan, and the specific resources present.

A **management goal** is a broad overarching purpose for an area. Goals have been developed through the planning processes of BLM and other agencies for the watersheds being considered in this and other studies. For example, the Steese National Conservation Area (SNCA) RMP establishes a goal of improving the water quality of Birch Creek National Wild River. "This will be accomplished by: 1) reducing the amount of sediment released into Birch Creek and its tributaries by placer mines, including those outside the SNCA boundaries; and 2) requiring reclamation of ground disturbed by mining to prevent stream sedimentation caused by erosion" (BLM 1986b).

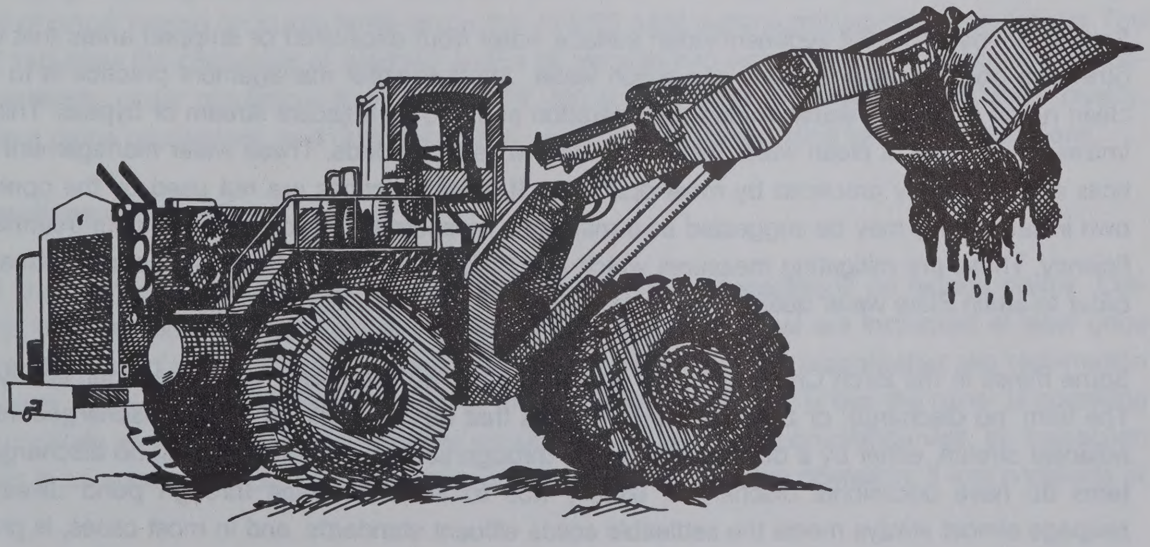
Mining techniques are the methods miners employ to operate their mines. Mining techniques include activities associated with exploration, access, development, mineral extraction, and reclamation. Techniques used for mining and mitigation measures that are used to meet the performance standards are often site- specific and are defined in the appropriate Environmental Assessment (EA) for a Plan of Operation.

Action Scenario for Mining and Reclamation Activities

There are several mining methods available that could be used to achieve the identified standards. One such scenario is presented here as an example. Other methods are presented in varying detail in numerous publications, such as "Best Management Practices for Placer Mining" (ADF&G 1986c) and "Placer Mining Demonstration Grant Project Final Report" (ADEC 1987c). These other mining methods and their associated surface disturbances are similar to the mining method and surface disturbance descriptions that follow.

After mining equipment has been transported to the site, a camp is set up for the duration of the season. The mining season generally lasts from June until the ground freezes in late September or October. The camp usually accommodates from two to five people with support facilities for maintenance and storage. After the camp is established, the associated physical mining infrastructure is constructed with a bulldozer or other earth moving equipment. This infrastructure usually consists of two or more settling ponds, associated dikes and spillways, drainage ditches to prevent erosion and collect runoff and groundwater, and working areas for the washplant, pumps, and motors. If the area to be mined is within an active stream channel, a bypass is built to route the water around the mining area. The bypass is diked to withstand ordinary floods and to keep contaminated mine water from entering the stream.

Actual mining activities usually begin after the infrastructure has been constructed. Trees and brush are cleared, and topsoil and overburden are stripped from the area to be mined. The stripped topsoil and overburden are stockpiled (separately if possible), usually near the mine cut, and are protected from erosion and flooding. With adequate planning, these stockpiles may be placed in a manner that promotes efficient site reclamation through reduced material handling and shorter hauling distances. Topsoil may have been stripped during the preceding mining season to allow permafrost in layers of overburden or gold-bearing gravel to thaw. If not, frozen overburden and topsoil may be ripped and stockpiled by bulldozer. The extent of the area to be stripped depends upon the



Front-end Loader

expected rate of production. On a typical mine, one to two acres are usually stripped before actual mining begins. Total disturbance for an entire mine at any one time averages between three and eight acres, although some of the larger mines may disturb up to 25 acres.

Exposed gold-bearing gravels are usually mined using a bulldozer that pushes and stockpiles the gravel near the washplant. A few operations use a dragline for these tasks. The stockpiled gold-bearing gravel is then fed into the washplant by a front-end loader or large backhoe. This practice promotes equipment efficiency by allowing the bulldozer or dragline to continue mining while the loader or backhoe feeds the washplant at a steady rate. When the mined gravel is fed into the washplant, it is classified by size using various stationary or vibrating screens. Classifying provides for more efficient gold recovery, reduced water consumption, and facilitation of mine site rehabilitation, and is practiced by most mine operators. The oversize material, usually larger than two inches, slides out of the washplant into a pile where it is moved by a front-end loader or bulldozer. The undersize material and gold-bearing gravel is mixed with water and flows through the sluice box where the gold and heavy black sands are concentrated. Tailings are the gravel, sand, and other materials which accumulate at the end of the sluice box. Tailings are routinely removed by a loader or pushed away by a bulldozer.

The water that carries the gold-bearing gravel through the sluice box becomes sediment laden and turbid. This "dirty" process water flows from the end of the sluice box through a pile of deposited tailings and into a series of settling ponds. These ponds are designed to hold the "dirty" water long enough to allow the fine sediments to settle out, then the process water is discharged to the adjacent stream. The physical requirements of the ponds are dependent upon the amount of water flowing through the system, the sediment characteristics of the gravels being worked, and the physical characteristics of the site. Most mines utilize a series of small settling ponds to permit flexible water management. Small ponds are usually easier to build, repair, clean, replace, bypass, and rehabilitate. The use of "pre-settling ponds" is encouraged. A pre-settling pond is located in the tailrace between the sluice and the first settling pond. Sands and other heavy settleable solids are collected here where they are easy to separate.

Settling ponds also treat sediment-laden surface water from excavated or stripped areas that would otherwise pollute "clean" surface and runoff water. Another water management practice is to divert clean runoff or ground water around the operation and into an adjacent stream or bypass. This minimizes the amount of clean water that flows into the settling ponds. These water management practices are commonly practiced by most operators. If these practices are not used by the operator's own initiative, they may be suggested as a mitigating measure to improve mine effluent treatment efficiency. These are mitigating measures which ADEC, EPA, and ADF&G apply to priority streams in order to attain State water quality standards.

Some mines in the Birch Creek drainage operate with a "no discharge" water management system. The term "no discharge" or zero discharge, implies that no mine effluent will be discharged into the adjacent stream, either by a direct discharge or through seepage. However, most no discharge systems do have occasional discharges, usually due to water seepage through pond dikes. This seepage almost always meets the settleable solids effluent standards, and in most cases, is probably of better water quality than the water discharged from typically operated settling ponds, i.e., less settleable solids and lower turbidity. Carefully designed and implemented water management practices are required to achieve zero discharge of "dirty" water into adjacent streams. Water used in the sluicing process is pumped from the nearby stream through the washplant and into the settling ponds. Water intake from the stream is suspended when the ponds contain adequate water to support continued sluicing operations by recycling pond water to the washplant. In some cases, groundwater seepage into the settling ponds may be sufficient to eliminate the need for adding stream water to the system. The practice of zero discharge and the recycling of mine water contributes to compliance with federal effluent limitations and State water quality standards.

For the typical placer mine on federal claims, reclamation begins upon completion of the final mine cut or at the end of the mining season. If mining has been completed at the location, tailings are moved into the mine cut and the site is leveled or reshaped. The leveled tailings are then covered with available overburden and topsoil. These actions are usually completed with a bulldozer. Settling ponds may be reclaimed by stopping water inflow and allowing the ponds to drain. Tailings are then pushed over the ponds to contain the captured settleable solids and armor the basins from future erosion. Overburden and topsoil, if available, are spread over the armored ponds as well. The reclaimed site is allowed to revegetate naturally.

If mining has not been completed at the location, the mine site is stabilized in preparation for the next mining season. Settling ponds that will be used in future operations are isolated from additional water inflow, while ponds of no further use are reclaimed as discussed above. Berms around ponds, stream bypasses, and the active mine site are reinforced and equipment is moved to high ground.

2.3.1 Actions Common to all Alternatives

Existing Laws and Regulations

Some management actions which are applied to mining under all alternatives are those established by existing laws, regulations, or RMP decisions (Sections 1.6 & 1.8). BLM provides overall management of placer mining on public lands under the 43 CFR 3809 surface management regulations. The COE regulates the placement of dredged and/or fill material into waters of the United States, including wetlands, under regulations found at 33 CFR 320 et seq. Other agencies manage water quality, fish and game populations, and other resources under their corresponding laws and regulations.

Inspections and Bonding

BLM compliance officers conduct inspections of placer mining operations on federal claims. Currently, all operations are inspected at least once each year, and most are inspected at least once during the mining phase of the operation and once at the end of the season after site reclamation has been completed. The primary concern of the compliance inspector is that the miner is operating appropriately and that reclamation work is acceptable. During each compliance visit, an inspection record is completed that describes the inspector's observations of the operation. If any problems or violations exist at the mine site, the compliance inspector discusses them with the operator, sets a time frame for correction of the situation, and issues a notice of noncompliance, if necessary. The mine site is revisited to ensure that corrective actions have taken place.

Bonding of placer mine operators on federal claims is a management tool which is authorized by the surface management regulations in 43 CFR 3809.1-9. Bonding can ensure that a mine site is reclaimed to the satisfaction of the authorized officer. By Bureau policy, bonding of mining operations at the plan level is a discretionary action; however, bonding is required when an operator has established a record of noncompliance. "A record of noncompliance is established when an operator: a) fails to take necessary actions on a notice of noncompliance issued under an approved plan, a previous plan, or a notice, until enjoined in a proper court, or b) conducts operations other than casual use without submitting a Notice or acquiring an approved Plan and fails to file a Notice or a Plan until served a notice of noncompliance" (BLM Manual, DOI 1985). The bond amount is usually equal to the estimated cost for the BLM to complete adequate reclamation at the mine site.

Access

Access to the area from Fairbanks is via an improved gravel highway, the Steese Highway, and then by unimproved gravel roads to most mines. The Steese Highway and the other gravel roads are old mining trails that have been upgraded and maintained by the State and are capable of handling the transportation of heavy mining equipment. The more remote areas in the drainage are reached by following winter trails. Summer surface access to these remote sites is generally restricted as determined by Plans of Operation and other environmental documents completed by the BLM or Alaska Department of Natural Resources.

2.3.2 Proposed Action (Status Quo)

The Proposed Action for this EIS would continue the management of mining for claims on federal lands as it was conducted during the summer of 1987 under 43 CFR 3809. In 1987, there were approximately 65 active mines in the Birch Creek watershed. About two-thirds of these mines operated on federal claims. Analysis of the cumulative effects of this Proposed Action includes the past and projected future impacts from federal, State, and private mines, and other non-mining activities in the region.

Standards

The water quality performance standards of significance would be the current EPA effluent guidelines and ADEC water quality standards or the existing EPA/ADEC variance for the operation. The performance standards would be .2 ml/l of settleable solids and 5 Nephelometric Turbidity Units (NTU) above natural conditions when the natural turbidity is 50 NTU or less, and not more than 10% increase in turbidity when the natural condition is more than 50 NTU, not to exceed a maximum increase of 25 NTU at the mine effluent discharge point (18 Alaska Administrative Code 70.020, ADEC 1987b). This detailed turbidity standard will be referred to throughout the EIS as the **5 NTU turbidity standard**.

Reclamation under the Proposed Action calls for soils and creek channel to be stabilized, and natural revegetation and restoration.

Action Scenario Under This Proposed Action

Mining activities under the Proposed Action would be expected to be very similar to the actual mining activities that occurred during the 1987 mining season. Mining operations that utilized zero discharge water treatment systems would probably stay with that treatment system. Some operators would probably try to utilize other systems, such as tailings or tundra filtration, to meet the water quality standards, while a few large operations would use flocculation as a secondary water treatment technique. The remaining operations would probably receive EPA variances from the water quality standards and would treat mine effluent entirely through a simple settling process.

Reclamation activities under the Proposed Action would be to reshape tailings to approximate the surrounding topography and to spread overburden and available topsoil over the reshaped tailings. Settling ponds would be reclaimed as previously described and the stream bypass stabilized or reinforced to make it the permanent stream channel. The reclaimed site is allowed to revegetate naturally.

In calculating cumulative impacts one should know about the past, present, and reasonably foreseeable future. In this EIS, the past number of acres of disturbance has been calculated by BLM. Reports like that of Hagler, Bailly and Co. (1987) have summarized historical data of the Birch Creek drainage. The present is calculated using BLM knowledge and field work, and resources such as the Annual Placer Mining Applications. The future is projected using the methodologies given in Appendix B- 1. For the purpose of the present analysis, it must be realized that the actual interrelationships are complex and largely unknown. Cumulative impacts must be dealt with in the only manner possible under the circumstances, and are considered simply to be additive.

The following figures are used to evaluate the present number of mines and to project the future number of mines and associated roads, disturbances, reclamation, and environmental impacts, and place placer mining in perspective as a use of public lands.

Figure 2-2 compares the number of mines in 1987 to the expected number in 1998 under each alternative.

Figure 2-3 is a reclamation and disturbance summary of present mining (1987), used as the baseline, and the projected mining situation for each alternative. Figure 2-4 is a summary of the present (1987) miles of roads and trails and the number of miles of roads and trails projected for each alternative. (Appendix B-1 for methodology).

		Projected 1998				
	1987	Proposed Action	Alternative A	Alternative B	Alternative C	Alternative D
Federal Mines	39	48	42	42	35	0
State Mines	26	32	28	28	23	32
Total	65	80	70	70	58	32

Figure 2-2. Comparison of 1987 State and federal mines against projected 1998 State and federal mines under the Proposed Action and the alternatives.

		Projected 1998				
Pre-1981 Disturbance-3,079	1987	Proposed Action	Alternative A	Alternative B	Alternative C	Alternative D
Federal Disturbance	220	1,104	966	966	805	0
State Disturbance	370	736	644	644	529	736
Total	590	1,840	1,610	1,610	1,334	736
Federal Reclamation	75	672	588	588	490	0
State Reclamation	25	0	0	0	322	0
Total	100	672	588	588	812	0

Figure 2-3. Comparison of 1987 State and federal mine disturbance and reclamation by acres against projected 1998 figures under the Proposed Action and the alternatives.

			1998 PROJECTION									
	1987		Proposed Action		Alternative A		Alternative B		Alternative C		Alternative D	
Jurisdiction	**Roads**	**Trails**	**Roads**	**Trails**	**Roads**	**Trails**	**Roads**	**Trails**	**Roads**	**Trails**	**Roads**	**Trails**
Federal**	58.2	65.9	147.4	59.3	128.2	51.6	128.2	51.6	107.6	43.3	58.2	65.9
State/Priv.	15.5	0	21.7	0	18.9	0	18.9	0	15.8	0	73.6	0
Joint	37.1	0	51.9	0	45.2	0	45.2	0	37.9	0	0	0*
Total	110.8	65.9	221.0	59.3	192.3	51.6	192.3	51.6	161.3	43.3	131.8	65.9

Does not include Steese Highway.
* All joint trails become state/private roads.
** Trails south of Birch Creek will not become roads.

Figure 2-4. Comparison of various 1987 road/trail jurisdictions and projected 1998 jurisdictions by miles.

2.3.3 Alternative A

This alternative would emphasize mining activity as regulated by 43 CFR 3809 and the minimum actions needed to implement the regulations. These regulations identify guidelines for determining "undue and unnecessary degradation to the environment" and reclamation. Figure 2-5 shows a comparison of the performance standards between alternatives.

Standards

The water quality performance standards would be the current EPA/ADEC standard of .2 ml/l settleable solids and the 5 NTU turbidity standard when measured 500 feet below the mine discharge point. No water quality variances would be incorporated in this alternative. Soils and stream channels would be stabilized, and natural restoration and revegetation would be allowed to proceed. All federal claims would meet these standards.

Action Scenario Under This Alternative

Alternative A would allow the discharge of mine effluent settleable solids of .2 ml/l with the 5 NTU turbidity standards; no EPA variances would be allowed. Most mines operating in the Birch Creek drainage probably did not meet the turbidity requirements during 1987 if they discharged mine effluent into the stream, unless they were granted a variance from EPA. It would be unlikely that most mines could discharge any mine effluent into the stream and meet turbidity standards without the expenditure of considerable effort and money for a complicated water treatment system. A few mines would be able to afford these systems (gel logs or other flocculation techniques are two types), but for the average-sized mine, it would be simpler and more cost-effective to operate by recycling mine water with no discharge into the stream, if possible.

Performance standards for reclamation of fish and wildlife habitats, and soil and vegetation stabilization would be less restrictive to mining activities than those standards required by current practices. Under Alternative A, disturbed topsoil and overburden would be stabilized to prevent erosion into the watershed, but the redistribution of these materials over the tailings would not be required. Tailing piles and open mine cuts would be stabilized and reshaped to allow for natural restoration. This would probably be accomplished by leveling the mine cut and tailing piles with a bulldozer. Any constructed stream bypass would be stabilized or reinforced to make it the permanent stream channel.

2.3.4 Alternative B

This alternative would combine the standards from the 43 CFR 3809 regulations with emphasis on standards established to meet management goals defined in the Records of Decision of the various plans for the watershed. For a clear portrayal of the differences between the alternatives, see Figure 2-5.

OPERATIONS	Proposed Action	Alt. A	Alt. B	Alt. C	Alt. D
Water Discharge, including runoff	.2ml/l, 5 NTU turbidity. EPA variances	.2ml/., 5 NTU turbidity, no variances	.2ml/., 5 NTU turbidity, no variances	0 ml/l, 0 NTU turbidity, no variances	N / A
In–stream channel ops.	No limits	No limits	No limits	Careful/limited	N / A
Vegetation Stripping of area	No limits	No limits	No limits	No limits	N / A
Soils Topsoil	Save, stabilize against erosion	Stabilize against erosion	Save, stabilize against erosion	Save, stabilize against erosion	N / A
Shape of site	Stabilize to reduce erosion	Stabilize to reduce erosion	Stabilize to reduce erosion	Stabilize to reduce erosion	N / A
Access	Per RMP	Per RMP	Per RMP	Per RMP	N / A

RECLAMATION

Water Creek configuration	Remain in bypass	Remain in bypass	Remain in bypass	Reestablish grade & configuration in floodplain	Remain in bypass
Fish habitat	Provide for fish passage; comply with ADF&G regs.	Provide for fish passage; comply with ADF&G regs.	Provide for fish passage; comply with ADF&G regs.	Rebuild w/rocks, pools, riffles, etc.	No requirements
Soils Shape of site	Reshape to approximate surrounding physiography	Stabilize to reduce erosion	Reshape to approximate surrounding physiography	Reshape to approximate surrounding physiography	Reshape to approximate surrounding physiography
Fines–ponds	Protect from erosion	Protect from erosion	Protect from erosion	Respread over tailings	Protect from erosion
Topsoil	Respread over tailings	No requirements	Respread over tailings	Respread over tailings	No requirements
Vegetation Revegetation	Natural succession	Natural succession	Natural succession	Fertilize & reseed w/native species	Natural succession
Refuse Human waste	Keep out of stream	Keep out of stream	Keep out of stream	Keep out of stream	Keep out of stream
Garbage	Remove	Remove	Remove	Remove	Remove
Chemicals	Remove	Remove	Remove	Remove	Remove

Figure 2-5. Comparison of the alternatives.

Standards

Water quality performance standards would be defined by current ADEC and EPA regulations as .2 ml/l settleable solids, and the 5 NTU turbidity standard when measured 500 feet below the mine discharge point. Stabilization of soils and creek channel would be conducted so that natural recovery and revegetation processes would be enhanced.

Action Scenario Under This Alternative

Performance standards for water quality would be the same as those under Alternative A. Reclamation standards require that disturbed topsoil and overburden would be stabilized to prevent erosion and soil loss during operations. After completion of mining on a site, the stockpiled material would be redistributed over the shaped mine site to facilitate natural revegetation. Any stream bypass would be stabilized to allow for natural recovery of the stream channel.

Mining methods similar to those used in the Birch Creek drainage in 1987, as discussed in the Proposed Action, could be used to achieve the standards outlined in this alternative. A design that results in zero discharge may be necessary to meet the water quality standards. Reclamation of the creek channels and soils, with redistribution of topsoil over reshaped tailings, would meet the standards of enhancing the natural recovery processes.

2.3.5 Alternative C

This alternative focuses on various standards proposed or under discussion by EPA and COE during 1987 (COE 1987, EPA 1987a). All mining operations in the watershed would meet the proposed standards. Figure 2-5 shows a clear comparison of performance standards used for this and other alternatives.

Standards

The discharge water quality performance standard for this alternative would be zero ml/l settleable solids and turbidity of zero NTU above natural conditions. Reclamation standards would emphasize restoration to a naturally-appearing landscape configuration, rehabilitation of creek channels, and regrowth of native vegetation. Mining activities would be conducted to minimize impacts to wetlands and riparian zones.

Action Scenario Under This Alternative

Alternative C water quality performance standards would be more stringent than those proposed in Alternatives A and B. Under this alternative, the miner would have two realistic options in choosing an appropriate water treatment method for the operation. These options would be: 1) to employ a chemical treatment system to reduce mine effluent settleable solids to zero and turbidity to acceptable levels, or 2) to not discharge any effluent to the stream.

Given these choices, most operators in this drainage would probably choose a zero discharge operation because it is presently more reliable and more cost-effective than a chemical system. Chemical treatment systems employ technology which has thus far had only limited success for mining operations in Interior Alaska.

Reclamation standards would be similar to those imposed on current operations, except that restoration would be enhanced. Reclamation may include the removal of captured fine sediments from settling ponds for distribution over shaped tailings, selective seeding or planting of reclaimed areas as appropriate, or constructing habitat to enhance fish populations within disturbed streams.

Further work may be required to meet the reclamation standards of Alternative C. This may include fertilizing and seeding or planting with native species, and rebuilding the creek channel in the original floodplain. The creek would be designed to have pools, riffles, and other natural features. Fine materials from settling ponds may be removed and redistributed over the tailings. Access roads and camps would be designed and constructed to reduce impacts on wetlands (COE wetland definition) and riparian zones. Actions of these types would be required on all mining operations, regardless of land status or size.

2.3.6 Alternative D

Alternative D is the "no action" alternative defined by the District Court. See Figure 2-5 for a comparison of performance standards between alternatives.

Standards

Under this alternative, no applications for Plans of Operations or Notices would be processed or approved by BLM. This action would violate current regulations (43 CFR 2091.1 for accepting application, and 43 CFR 3809.1-6 for processing applications). This action would also violate the 1872 Mining Law which gives a mining claimant the right to operate subject to surface management regulations. Changes would be required in these regulations and laws to legally implement this alternative.

Validity examinations would be conducted for each properly filed mining claim, and the owners of valid claims would be compensated accordingly. Stabilization of surface disturbance that has occurred since 1980 would be required on all federal claims. Further restoration would be allowed to proceed by natural processes.

Action Scenario Under This Alternative

This alternative would require that mining cease on all federal claims within the watershed. BLM would conduct validity exams for all recorded claims, and the owners would be compensated for their interest in the claims. This would require Congressional appropriation of funds. Reclamation standards would be similar to those imposed under Alternative A. Areas disturbed after 1980 would be stabilized with minimal work, and reclamation would be allowed to proceed by natural processes.

2.4 Alternatives Considered, But Eliminated From Further Analysis

During the scoping process, many alternatives were suggested that were considered for analysis but not selected for further study:

1) Various levels of BLM enforcement, including compliance visits and administration of Plans of Operation applications.

Various levels of enforcement have been included in evaluating the alternatives.

2) Requiring specific mining and reclamation methods.

This range of alternatives was not selected for three reasons: 1) The variation in the natural and mineral-bearing characteristics of the mining areas requires site-specific methods. Limiting all operations to a predetermined set of mining methods would reduce flexibility, and could increase environmental impacts. 2) Mining and reclamation technology is in a state of development and transition. Specific methods would rapidly become out of date and limiting. Emerging technologies are generally better both for mineral recovery and for environmental reclamation, and requiring static technology would restrict both activities. 3) These types of factors receive site-specific consideration in the preparation of EA's required for each Plan of Operation.

3) Changes in regulations and standards by other agencies.

This idea was partially used in Alternative C. The changes in standards are limited to those that were actually being proposed by EPA or being discussed by the COE at the time BLM developed the alternatives in July-November, 1987. Other changes were not incorporated because other agencies are mandated with those tasks, and these standards are outside immediate BLM jurisdiction.

4) Various alternatives which result in less restrictive standards, especially for water quality.

Water quality alternatives are developed from existing and proposed agency standards. This EIS will calculate the cumulative effects of these standards, and BLM's posture is to require the operator to comply with all existing State and federal water quality standards.

Pursuant to 33 USC 1371(c)(e), BLM may not impose effluent limitations that are different from those established by EPA and ADEC.

5) Alternatives that would redesignate Birch Creek, including removing the Wild River status of the stream, or changing the drinking water standard to the industrial standard.

These alternatives were not used because they would require action by Congress or the State of Alaska. This was not considered to be a "reasonable" alternative for implementation at this time. This alternative was evaluated in the EIS for the D2 actions which designated Birch Creek as a National Wild River (DOI 1974) The Wild River status could be reconsidered as a separate action with an attendant EIS.

6) An alternative with no performance standards and no regulation.

This alternative was not used because it would essentially revisit the issue that the 43 CFR 3809 regulations were originally intended to address. The no regulation alternative is the "no action" alternative evaluated in the "EIS for Surface Management of Public Lands Under the U.S. Mining Laws, 43 CFR 3809" (DOI 1980). A variation of this alternative would set low performance standards, and issue miners a "license" to mine.

2.5 Summary of Environmental Consequences of the Alternatives

Cumulative Impacts

The evaluation of cumulative impacts requires the integration of time, space, mining/non-mining and federal/non-federal actions in a complex and dynamic environment. This section summarizes the cumulative impacts of multiple placer mines in the Birch Creek watershed. The spatial aspect is covered by considering the impacts of multiple mining operations in the headwaters of Birch Creek (Placer Mining Operations and Access Roads Map, Chapter Three). Time is considered by evaluating the past, present, and reasonably foreseeable actions of placer mining. Past and present impacts are part of the existing environment, discussed in detail in Chapter Three, Affected Environment. The projected number of mines, acreages of disturbance, and miles of roads and trails were calculated using methods outlined in Appendix B-1, and are summarized in Figures 2-2, 2-3, and 2-4. Further details on future impacts are in Chapter Four, Environmental Consequences. Impacts from non-federal mines are included in the discussions of current environment and projected impacts. In particular, the impacts of Alternative D, no mining on federal claims, show the effects from mining on State and private lands. Non-mining actions are discussed in Chapters Three and Four as appropriate.

Figure 2-7, at the end of Chapter Two, illustrates the impacts by showing past, 1987, and projected 1998 impacts for the Proposed Action and each Alternative.

Projection of Mines

Eighty mines (48 federal and 32 State and private mines) were projected to be operating in the Birch Creek drainage (primarily in Crooked Creek, Harrison Creek, and headwaters of Birch Creek) over the next ten years under the Proposed Action. This number was determined by using a one-to-one relationship between the 1987 price of gold and the number of mines operating during 1987 to predict the number of mines expected to be operating in 1998 with an estimated gold price of $600 per ounce. This estimated gold price was approximately a 23% increase over the highest 1987 price of $475 per ounce, so a corresponding increase in the number of mines was projected for 1998. This level of mining activity was projected so that the cumulative environmental effects of increased mining activity within the drainage could be assessed.

Projecting the number of mines that would operate under Alternatives A, B, and C was based on the compliance costs of these alternatives as compared to the Proposed Action's compliance costs. These costs for federal mines are listed in Figure 2-6, and a comparison clearly indicates that the estimated water treatment costs for Alternatives A, B, and C are significantly higher than those estimated for the Proposed Action. Due to these significant increases in compliance costs, BLM estimated that there would be a reduction in the number of mines operating under these alternatives. Under Alternatives A and B, 70 mines (42 federal and 28 State and private mines) were estimated to be operating in 1998. Similarly, 58 mines (35 federal and 23 State and private mines) would operate under Alternative C due to additional increases in water treatment and reclamation costs. These reductions are discussed further in the following paragraph. Under Alternative D, no federal mines would be operating, while 32 State and private mines would be operating under the standards of the Proposed Action.

The water treatment costs cited in Figure 2-6 were taken from an EPA report (EPA 1987a) that analyzed the economic impact of effluent standards on the placer mining industry. In the EPA report, six water treatment technology options were outlined and their associated costs for Alaska were estimated. BLM reviewed these options and selected the three treatment technologies that came closest to meeting the various water quality standards of the Proposed Action and Alternatives A, B and C. The Proposed Action treatment technology would be a simple settling system that consists of primary and secondary settling ponds operated with an EPA variance for turbidity discharge, similar to treatment technology option two. Alternative A and B, with water quality standards of .2 ml/l settleable solids and the 5 NTU turbidity standard, and no EPA variances, would require operating with no seepage of effluent to the stream, or the option four water treatment technology listed by EPA. EPA estimated that operating this water treatment system would reduce the operator's income by approximately 13%, so BLM reduced the number of mines that would operate by that same percentage. Alternative C, with water quality standards of zero ml/l settleable solids and zero NTU turbidity increase, would require operations comparable to the option 6c water treatment technology, including zero discharge, 100% recycle of process water, and flocculants. For this system, EPA estimated that the operator's income would be reduced by about 27%, so the number of mines was reduced by that percentage. The costs in Figure 2-6 are representative of a mine that processes 150,000 cubic yards per mining season.

A worst-case scenario to describe a level of placer mining more intense than expected was analyzed to predict those possible cumulative environmental impacts. This scenario could occur if unforeseeable circumstances caused this high level of activity, such as the price of gold increasing to $2,000 per ounce. The summary for this analysis is presented in Figure 2-8 and the assumptions are listed in Appendix B-2.

2.5.1 Proposed Action (Status Quo)

The effects of the Proposed Action are based on 80 mines (48 federal and 32 State and private) operating continuously for the next ten years.

There should be no significant cumulative impacts on topography of public lands. There would be some short-term modification of site aspect during mining which would, however, not significantly impact the overall topographic setting of the affected area, since the required reclamation would include reconfiguration and stabilization. State and private lands would have some local, long-term impacts on the topography since reclamation on these lands is not required.

There should be no significant impacts on mineral resources.

The soil profile would be completely altered by mining operations on approximately 1,840 acres of ground. Soil conditions may be impacted by access roads and trails through direct disturbance of the soil profile, enhanced erosion, or from compaction.

Water quality would return to approximately natural conditions after successful stabilization of the disturbed area and stream channel. Unavoidable adverse impacts would be significant short- to long-term increases in suspended sediment and turbidity, and accelerated erosion resulting in a possible increase in sediment (1,852 tons per day) introduced to the stream system, and changes in channel morphology (20 miles) in the vicinity, and downstream of the disturbed area. The impact on chemical water quality is not known.

The vegetation cover would be destroyed in mine and road areas. A short-term loss of productivity is unavoidable. Three hundred forty-seven acres would regrow to a riparian tall shrub community within 30 years of reclamation, with an additional 599 acres within 50 years on mining disturbance in creek bottoms. One thousand, three hundred fifty-four acres of new mining disturbance would remain barren or sparsely vegetated.

There are no "listed" or "candidate" threatened or endangered plant species within the watershed. Mining and associated activities would have no known direct effect upon the one endemic sensitive plant species involved, *Poa porsildii.*

Approximately 6,258 acres of wildlife habitat would be physically altered due to mining-related activities. Periodic disturbances to wildlife due to the operation of vehicles and machinery, and human habitation affecting 223,000 acres could result in a low to moderate level of short-term cumulative effects. The principal long-term adverse effect of mining would be the unavoidable loss of approximately 947 acres of the moose habitat winter range in Crooked Creek, Harrison Creek, and the headwaters of Birch Creek for a 30 to 50-year period. The long-term cumulative loss of habitat to federal (1,104 acres) and State and private (736 acres) mining activities in these areas would probably contribute to a low to moderate reduction in moose population potential. The potential exists for long-term cumulative adverse effects to wildlife if mining activity and human use of the area increases greatly in crucial wildlife habitats.

There are five to eight known peregrine falcon breeding pairs in the watershed. Protective measures would be required for any mining activity planned within one mile of these nests. No anticipated activities are within one mile of any known nest areas.

Physical alteration of 20 miles of streams (12 miles due to federal claims, eight State/private) and increases in suspended sediment from 80 mines in the basin will result in adverse cumulative effects on the aquatic resources. The clear flowing headwater reaches of streams that are blocked to fish passage would also be unavailable as habitat to some fish populations in the affected area. The overall cumulative adverse effect of total suspended sediment increases in Birch Creek cannot be determined.

Cumulative impacts on cultural resources in the Birch Creek drainage do not appear to be significant.

Much of the Birch Creek drainage downstream from mining is used by residents of villages and communities in the region for subsistence purposes. Such traditional subsistence activities include hunting, fishing, and trapping, with residents of Birch Creek village also utilizing the river for drinking water and as a transportation route to various resource harvest areas. By 1987, however, certain subsistence activities and resources in the lower Birch Creek drainage are reported by residents to have been significantly impacted by poor water quality and sedimentation. These effects may be largely due to past and current upriver mining. Suspended sediments in Birch Creek are effecting the drinking water supply of Birch Creek village. According to Birch Creek village residents, certain fish and wildlife species near Birch Creek village no longer are abundant or available as in previous years. Also, certain traditionally used lake and riverine areas are now filled with sediment, thus impeding or totally preventing boat access. While mining in 1987 on federal lands was not a cause for this largely pre-1987 impact, neither will it be a remedy. The condition of an ongoing significant restriction to subsistence uses occurring in the Birch Creek drainage in 1988 will not be reversed in the short term even if no mining occurred in the Birch Creek for the next three to five years. While water quality would show improvement, sediments from past mining now in the river system will be resuspended and continue to wash downstream, adding to the areas already impacted by sedimentation. In the longer term, high water would flush out some of these sediments, but other sediments will outlast the present subsistence users and may persist for several generations. As to other effects from this Proposed Action, some opportunities would be created for more hunting, fishing, and trapping by improved access into the headwaters of Birch Creek. Those activities would be regulated by the ADF&G. Presumably they would be pursued more by sport persons whose harvest would be from game stocks mostly distinct from those hunted for subsistence purposes downriver. Other subsistence activities, such as berry picking and wood harvest, would not be impacted by mining.

Motorized recreational activities would be enhanced due to the increased access provided by additional mining roads. Increased mining activity would detract from the semi-primitive experiences in drainages north of Birch Creek. Visitor use of the Wild River corridor would continue near 1987 levels.

Visual resources would be impacted by the increased road mileage and additional disturbed areas from mining. Meeting water quality standards would improve the perception of a wild and natural landscape by river recreationalists and others.

If the total number of mines increased from 65 to 80 (23%) over the next decade, it is reasonable to assume that mining expenditures, total output, mining employment, total employment, mining income, and total income would also increase by about 23%.

Annual costs for water treatment and reclamation for all federal mining operations would be $249,600 and $96,000 respectively. Administration and enforcement of the Surface Management program for placer mining would cost BLM about $86,400 annually (all values in 1987 dollars). Figure 2-6 is a summary of the estimated unit costs for federal mines associated with the implementation of each alternative. Costs for State and private mines were not estimated because BLM has no regulatory authority for these operations; however, water treatment costs would probably be similar to the costs for federal mines. No reclamation is required for State and private mines.

Costs Per Federal Mine	1987 (39 mines)	Proposed Action (48 mines)	Alternatives			
			A (42 mines)	B (42 mines)	C (35 mines)	D (No mines)
Reclamation Cost	$1,500	$2,000	$1,000	$2,000	$3,400	NA
Water Treatment Cost	$5,200	$5,200	$36,500	$36,500	$47,000	NA
BLM Administrative Cost	$1,800	$1,800	$1,400	$2,200	$2,600	See Caption

Figure 2-6. Estimated costs for federal mines associated with implementation of each alternative. Sources: BLM. EPA. NPS. For Alternative D, validity examinations and appraisals were estimated to cost $2,000 per claim, and the net present value of each claim was estimated to be between $12,000 and $335,000. See Appendix B-3 for methodology for computing costs.

2.5.2 Alternative A

The effects of this alternative are based on 70 mines (42 federal and 28 State and private) which would operate continuously for the next ten years.

There should be no significant cumulative impacts on topography of public lands. There would be some short-term modification of site aspect during mining which would, however, not significantly impact the overall topographic setting of the affected area, since the required reclamation would include reconfiguration and stabilization. State and private lands would have some local, long-term impacts on the topography since reclamation on these lands is not required.

There should be no significant impacts on mineral resources.

The soil profile will be completely altered by mining operations on approximately 1,610 acres of ground. Soil conditions may be impacted by access roads and trails through direct disturbance of the soil profile, enhanced erosion, or compaction.

Water quantity would not be significantly affected and water quality would return to approximately natural conditions after successful stabilization of the disturbed area and stream channel. Unavoidable adverse impacts are significant short- to long-term increases in suspended sediment and turbidity, and accelerated erosion resulting in a possible increase in sediment (1,671 tons/day) introduced to the stream system, and changes in channel morphology for the 17.5 miles of disturbed stream in the vicinity of the disturbed area. The impacts on chemical water quality is not known.

The vegetation cover would be destroyed in the areas of the mines and roads. A short-term loss of productivity would be unavoidable. Two hundred acres would regrow to a riparian tall shrub community within 30 years of reclamation, and an additional 580 acres within 50 years on mining disturbance in creek bottoms. One thousand, two hundred eighty-eight acres of new mining disturbance would remain barren or sparsely vegetated.

There are no "listed" or "candidate" threatened or endangered plant species within the watershed. Mining and associated activities would have no known direct effect upon the one endemic sensitive plant species involved, *Poa porsildii.*

Approximately 5,855 acres of wildlife habitat will be physically altered due to mining-related activities. Periodic disturbances to wildlife due to the operation of vehicles and machinery, and human habitation affecting 193,500 acres could result in a low to moderate level of short-term cumulative effects. The principal long-term adverse effect of mining will be the unavoidable loss of approximately 782 acres of the moose habitat winter range in Crooked Creek, Harrison Creek, and the headwaters of Birch Creek for a 30 to 50-year period. The long-term cumulative loss of habitat to federal (773 acres) and State and private (515 acres) mining activities in these areas would probably contribute to a low to moderate reduction in moose population potential. The potential exists for long-term cumulative adverse effects to wildlife if mining activity and human use of the area increases greatly in crucial wildlife habitats.

There are five to eight known peregrine falcon breeding pairs in the watershed. Protective measures would be required for any mining activity planned within one mile of these nests. No anticipated activities are within one mile of any known nest areas.

Physical alteration of 17.5 miles of streams (10.5 miles due to federal claims, seven State/private) and increases in suspended sediment from 70 mines in the basin will result in adverse cumulative effects on the aquatic resources. The clear flowing headwater reaches of streams that are blocked to fish passage would also be unavailable as habitat to some fish populations in the affected area. The overall cumulative adverse effect of total suspended sediment increases in Birch Creek cannot be determined.

Cumulative impacts on cultural resources in the Birch Creek drainage do not appear to be significant.

As described under the Proposed Action, certain subsistence activities and resources would continue to be significantly restricted under this or any other alternative (even with no mining) due to ongoing impacts from past mining in the Birch Creek drainage. However, mining on federal lands under this alternative would not further notably add to this ongoing cumulative impact condition of significant restriction to subsistence uses.

Impacts to recreation from mining and associated access would be greater than current levels, but less than the Proposed Action. Motorized recreational activities would be enhanced due to increased access provided by additional mining roads. Increased mining activity detracts from the semi-primitive experience, especially in drainages north of Birch Creek. Visitor use of the Wild River corridor would likely increase with the improved water quality in the mainstem of Birch Creek.

Visual resources would be impacted by the increased road mileage and additional disturbed areas from mining. Meeting water quality standards would improve perception of wild and natural landscapes by river recreationalists and others.

If the total number of mines increased from 65 to 70 (8%) over the next decade, it is reasonable to assume that mining expenditures, total output, mining employment, total employment, mining income, and total income would also increase by 8%. Annual costs for water treatment and reclamation for all federal mining operations would be $1,533,000 and $42,000 respectively. Administration and enforcement of the Surface Management program for placer mining would cost BLM about $58,800 annually (all values in 1987 dollars). Costs for State and private mines were not estimated because BLM has no regulatory authority for these operations; however, water treatment would probably be similar to the costs for federal mines. No reclamation is required for State and private mines.

2.5.3 Alternative B

The effects of this alternative are based on 70 mines (42 federal and 28 State and private) which would operate continuously for the next ten years.

There should be no significant cumulative impacts on topography of public lands. There would be some short-term modification of site aspect during mining which would, however, not significantly impact the overall topographic setting of the affected area, since the required reclamation would include reconfiguration and stabilization. State and private lands would have some local, long-term impacts on the topography since reclamation on these lands is not required.

There should be no significant impacts on mineral resources.

The soil profile would be completely altered by mining operations on approximately 1,610 acres of ground. Soil conditions may be impacted by access roads and trails through direct disturbance of the soil profile, enhanced erosion, or compaction.

Water quantity would not be significantly affected and water quality would return to approximately natural conditions after successful stabilization of the disturbed area and the stream channel. Unavoidable adverse impacts would be significant short- to long-term increases in suspended sediment and turbidity, and accelerated erosion resulting in a possible increase in sediment (1,671 tons per day) introduced into the stream system, and changes in channel morphology for the 17.5 miles of stream in the vicinity of the disturbed area. The impact on chemical water quality is not known.

The vegetation cover would be destroyed in mine and road areas. A short-term loss of productivity would be unavoidable. Three hundred four acres would regrow to a riparian tall shrub community within 30 years of reclamation, with an additional 587 acres within 50 years on mining disturbance in creek bottoms. One thousand, one hundred eighty- five acres of new mining disturbance would remain barren or sparsely vegetated.

There are no "listed" or "candidate" threatened or endangered plant species within the watershed. Mining and associated activities would have no known direct effect upon the one endemic sensitive plant species involved, *Poa porsildii.*

Approximately 5,855 acres of wildlife habitat would be physically altered due to mining-related activities. Periodic disturbances to wildlife due to the operation of vehicles and machinery, and human habitation affecting 193,500 acres could result in a low to moderate level of short-term cumulative effects. The principal long-term adverse effect of mining would be the unavoidable loss of approximately 886 acres of moose habitat winter range in Crooked Creek, Harrison Creek, and the headwaters of Birch Creek for a 30 to 50-year period. The long-term cumulative loss of habitat to federal (670 acres) and State and private (515 acres) mining activities in these areas would probably contribute to a low to moderate reduction in moose population potential. The potential exists for long-term cumulative adverse effects to wildlife if mining activity and human use of the area increases greatly in crucial wildlife habitats.

There are five to eight known peregrine falcon breeding pairs in the watershed. Protective measures would be required for any mining activity planned within one mile of these nests. No anticipated activities are within one mile of any known nest areas.

Physical alteration of 17.5 miles of streams (10.5 miles due to federal claims, seven State/private) and increases in suspended sediment from 70 mines in the basin will result in adverse cumulative effects on the aquatic resources. The clear flowing headwater reaches of streams that are blocked to fish passage would also be unavailable as habitat to some fish populations in the affected area. The overall cumulative adverse effect of total suspended sediment increases in Birch Creek cannot be determined.

Cumulative impacts on cultural resources in the Birch Creek drainage do not appear to be significant.

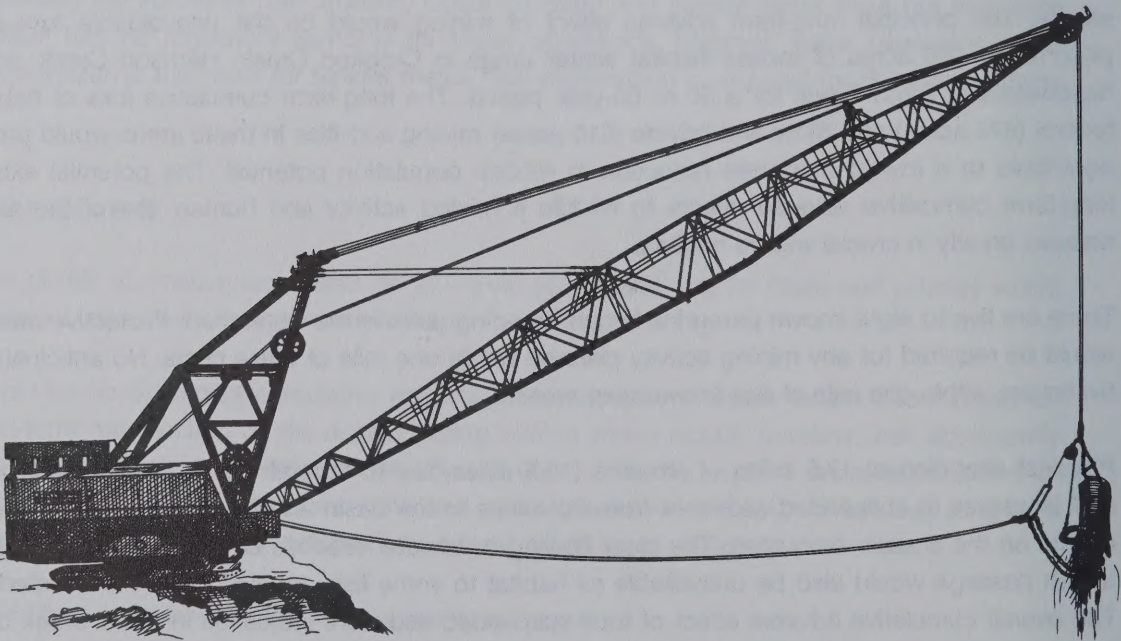
As described under the Proposed Action, certain subsistence activities and resources would continue to be significantly restricted under this or any other alternative (even with no mining) due to ongoing impacts from past mining in the Birch Creek drainage. However, mining on federal lands under this alternative would not further notably add to this ongoing cumulative impact condition of significant restriction to subsistence uses.

Motorized recreational activities would be enhanced due to increased access provided by additional mining roads. Increased mining activity would detract from the semi-primitive experience, especially in drainages north of Birch Creek. Visitor use of the Wild River corridor would likely increase with the improved water quality in the mainstem of Birch Creek.

Visual resources would be impacted by the increased road mileage and additional disturbed areas from mining. Meeting water quality standards would improve perception of a wild and natural landscape by river recreationalists and others.

If the total number of mines increased from 65 to 70 (8%) over the next decade, it is reasonable to assume that mining expenditures, total output, mining employment, total employment, mining income, and total income would also increase by 8%.

Annual costs for water treatment and reclamation for all federal mining operations are $1,533,000 and $84,000 respectively. Administration and enforcement of the Surface Management program for placer mining will cost BLM $92,400 annually (all values in 1987 dollars). Costs for State and private



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mines were not estimated because BLM has no regulatory authority for these operations; however, water treatment costs would probably be similar to the costs for federal mines. No reclamation is required for State and private mines.

2.5.4 Alternative C

The effects of this alternative are based on 58 mines (35 federal and 23 State and private) operating continuously for the next ten years.

There should be no significant cumulative impacts on topography. There would be some short-term modification of site aspect during mining which would, however, not significantly impact the overall topographic setting of the affected area, since the required reclamation would include reconfiguration and stabilization.

There should be no significant impacts on mineral resources.

The soil profile would be completely altered by mining operations on approximately 1,334 acres of ground. Soil conditions may be impacted by access roads and trails through direct disturbance of the soil profile, enhanced erosion, or compaction.

Water quantity would not be significantly affected and water quality would return to approximately natural conditions after successful stabilization of the disturbed area and the stream channel. Unavoidable adverse impacts would be significant short- to long-term increases in suspended sediment and turbidity, and accelerated erosion resulting in a possible increase in sediment (1,475 tons per day) introduced into the stream system, and changes in channel morphology, (14.5 miles), in the vicinity of the disturbed area. The impact on chemical water quality is not known.

The vegetation cover would be destroyed in mine and road areas. A short-term loss of productivity would be unavoidable. Three hundred eight acres would regrow to a riparian tall shrub community within 25 years of reclamation, with an additional 709 acres within 50 years on mining disturbance in creek bottoms. Seven hundred eighty-two acres of new mining disturbance would remain barren or sparsely vegetated.

There are no "listed" or "candidate" threatened or endangered plant species within the watershed. Mining and associated activities would have no known direct effect upon the one endemic sensitive plant species involved, *Poa porsildii*.

Approximately 5,391 acres of wildlife habitat would be physically altered due to mining-related activities. Periodic disturbances to wildlife due to the operation of vehicles and machinery, and human habitation affecting 162,108 acres could result in a low to moderate level of short-term cumulative effects. The principal long-term adverse effect of mining would be the unavoidable loss of approximately 1,012 acres of the moose habitat winter range in Crooked Creek, Harrison Creek, and the headwaters of Birch Creek for a 25 to 50 year period. The long-term cumulative loss of habitat to federal (472 acres) and State and private (310 acres) mining activities in these areas would probably contribute to a low to moderate reduction in moose population potential. The potential exists for long-term cumulative adverse effects to wildlife if mining activity and human use of the area increases greatly in crucial wildlife habitats.

There are five to eight known peregrine falcon breeding pairs in the watershed. Protective measures would be required for any mining activity planned within one mile of these nests. No anticipated activities are within one mile of any known nest areas.

Physical alteration of 14.5 miles of streams (8.75 miles due to federal claims, 5.75 State/private) and increases in suspended sediment from 58 mines in the basin will result in adverse cumulative effects on the aquatic resources. The clear flowing headwater reaches of streams that are blocked to fish passage would also be unavailable as habitat to some fish populations in the affected area. The overall cumulative adverse effect of total suspended sediment increases in Birch Creek cannot be determined.

Cumulative impacts on cultural resources in the Birch Creek drainage do not appear to be significant. Replacement of habitat would minimize the long-term impacts to fish habitat.

As described under the Proposed Action, certain subsistence activities and resources would continue to be significantly restricted under this or any other alternative (even with no mining) due to ongoing impacts from past mining in the Birch Creek drainage. However, mining on federal lands under this alternative would not further notably add to this ongoing cumulative impact condition of significant restriction to subsistence uses. Under this alternative, the condition of significant restriction to subsistence uses perhaps would be most quickly lessened since it is presumed that all other mines in the drainage would have improved water discharge.

Motorized recreational activities would be enhanced due to increased access provided by additional mining roads. Increased mining activity detracts from the semi-primitive experience, especially in drainages north of Birch Creek. Visitor use of the Wild River corridor would probably increase with the improved water quality from all mining operations.

Visual resources would be impacted by the increased road mileage and additional disturbed areas from mining. Meeting water quality standards would improve perception of a wild and natural landscape by river recreationalists and others.

The total number of mines within the watershed is projected to decrease from 65 to 58 (11%) over the next decade. If so, mining expenditures, total output, mining employment, total employment, mining income, and total income would also decrease by about 11%.

Annual costs for water treatment and reclamation for all federal mining operations are $1,645,000 and $119,000 respectively. Administration and enforcement of the Surface Management program for placer mining will cost BLM and the COE approximately a total $91,000 annually (all values in 1987 dollars). Costs for State and private mines were not estimated because BLM has no regulatory authority for these operations; however, water treatment and reclamation costs would probably be similar to the costs for federal mines.

2.5.5 Alternative D

The effects of this alternative are based on 32 State and private mines operating continuously for the next ten years. There would be no further placer mining on federal claims.

Cessation of mining would end further short- and long-term impingements upon topography of the public lands. Mining activity on State and private lands would cause some local long-term impacts on topography since reclamation is not required on these lands.

Placer mining activity would cease on public lands and gold resources would remain undeveloped. Mining activity would continue on State and private lands.

Soils on public lands would not be further disturbed by mining. Mining on non-federal lands would disturb the soil profile on 736 acres.

Water quality would not be significantly altered. It will return to near natural conditions after cessation of mining and natural stabilization of disturbed areas and the stream channel. Sediment from State and private mining operations is estimated to be 1,188 tons per day. Channel morphology would be changed on eight miles of mined stream.

The vegetation cover has been destroyed on federal mine sites and roads, resulting in a short-term unavoidable loss of productivity. There is a long-term unavoidable loss of over 4,000 acres of the vegetation cover in the area from historic mines and roads. Activity on State and private lands would result in 92 acres of shrubs regrowing within 30 to 50 years, and 516 additional acres regrown to shrub in 50 years. Five hundred eighty-eight acres would remain barren or sparsely vegetated from this mining.

There are no "listed" or "candidate" threatened or endangered plant species within the watershed. Mining and associated activities would have no known direct effect upon the one endemic sensitive plant species involved, *Poa porsildii.*

Approximately 4,834 acres of moose winter range would remain physically altered because of past mining related activities in Crooked Creek, Harrison Creek, and the headwaters of Birch Creek. Continued mining on State and private lands would result in the physical alteration of 736 acres. Periodic disturbances to wildlife due to the operation of mining vehicles, machinery, and human habitation at State and private mines would result in 144,122 acres subject to short-term adverse effects in localized areas during the mining season. Recreation use of existing roads and trails would facilitate increased harvest of wildlife. The principal long-term adverse effect of past mining would be the unavoidable loss of approximately 609 acres of moose range for 40 to 50 years. Additional habitat losses due to State and private mining (147 acres) would require approximately 50 years to become suitable for wildlife use. The long-term cumulative loss of habitat to mining activities in these areas would probably contribute to a low to moderate reduction in moose population potential. The potential exists for long-term cumulative adverse effects to wildlife if State and private mining activity and human use of the area increases greatly in crucial wildlife habitats.

Components	Past Pre-1981	Present 1987	Proposed Action 1998
Number of Mines Acreage Disturbed Acreage Reclaimed	Unknown 3,079 Unknown	65 590 100	80 1,840 672
Topography Minerals	NSI* NSI on development	Minimal impacts NSI on development	NSI NSI on development
Soils:			
-Acres of soil disturbed	3,079	590	1,840
Water Resources:			
-Channel morphology miles	Unknown	16.25	20
-Sediment load tons/day	Unknown	Unknown	1,852
-Toxic substances	Unknown	Unknown	Unknown
Landcover:			
-Permanently barren from mining	2,617	470	1,354
-Years to regrow to shrub community	50	50	30-50
-Threatened & endangered plants	Unknown	None perceived	None expected
Wildlife:			
-Acres of habitat permanently lost	672	672	1,350
-Acres of habitat disrupted	Unknown	32,630	223,000
-Acres of habitat lost for x years	460 ac./unknown yrs.	580 acres/30-50 yrs.	947 acres/30-50 yrs.
-Acres of habitat physically altered	3,079	3,760	6,258
-Threatened & endangered animals	NSI	NSI	NSI
Aquatic fauna:			
-Miles of habitat disturbed	Unknown	16.25	20
-Fish populations	Unknown	Short term impacts	Short term impacts
Cultural & paleontological resources	Mining created historical sites	No new sites discovered	No change in impacts
Subsistence	Significant restrictions to subsistence uses	Significant restrictions to subsistence uses	Significant restrictions to subsistence uses
Recreation & visual resources			
-Estimated recreation use	2,700 visitor days in 1973	925 visitor days	925 visitor days, increased access
Economics: local			Expenditures, output, employment, & income would change by about +23%
-Mining expenditures	Unknown	$786,000	
-Mining employment	Unknown	289 FTE	
-Mining income	Unknown	$374,000	

*NSI - No Significant Impacts

Figure 2-7. Comparison of pre-1981 impacts with those of the 1987 mining season and projected 1998 impacts under the Proposed Action and the alternatives.

Alternative A 1998	Alternative B 1998	Alternative C 1998	Alternative D 1998
70	70	58	32
1,610	1,610	1,334	736
588	588	812	0
Minimal impacts	NSI	NSI	NSI
NSI on development	NSI on development	NSI on development	No further mining on federal lands
1,610	1,610	1,334	736
17.5	17.5	14.5	8
1,671	1,671	1,475	1,188
Unknown	Unknown	Unknown	Unknown
1,288	1,185	782	588
50	30-50	25-30	50
None expected	None expected	None expected	None expected
1,166	1,166	978	799
193,500	193,500	162,108	144,122
782 acres/30-50 yrs.	886 acres/30-50 yrs.	1,012 acres/25-30 yrs.	736 acres/50 yrs.
5,855	5,855	5,391	4,834
NSI	NSI	NSI	NSI
17.5	17.5	14.5	8
Short term impacts	Short term impacts	Minimal impacts	Short term impacts
No change in impacts	No change in impacts	No change in impacts	No change in impacts
Significant restrictions to subsistence uses	Significant restrictions to subsistence uses	Significant restrictions to subsistence uses	Significant restrictions to subsistence uses
2,700 visitor days, increased access	2,700 visitor days, increased access	2,700 visitor days, increased access	Increased visitor use, increased access
Expenditures, output, employment, & income would change by about +8%	Expenditures, output, employment, & income would change by about +8%	Expenditures, output, employment, & income would change by about -11%	Expenditures, output, employment, & income would change by about -51%

There are five to eight known peregrine falcon breeding pairs in the watershed. Protective measures would be required for any mining activity planned within one mile of these nests. No anticipated activities are within one mile of any known nest areas.

Physical alteration of eight miles of streams (zero miles due to federal claims, eight State/private) and increases in suspended sediment from 32 mines in the basin will result in adverse cumulative effects on the aquatic resources. The clear flowing headwater reaches of streams that are blocked to fish passage would also be unavailable as habitat to some fish populations in the affected area. The overall cumulative adverse effect of total suspended sediment increases in Birch Creek attributable to State and private mining cannot be determined.

Cumulative impacts on cultural resources in the Birch Creek drainage do not appear to be significant.

As described under the Proposed Action, certain subsistence activities and resources would continue to be significantly restricted even if no mining were to occur on federal lands, or even if no mining occurred at all in the entire drainage, due to ongoing impacts from past mining. However, this alternative would not further add to the ongoing significant restriction already occurring in the area.

Some impacts would continue due to reclamation activities on federal claims and continued mining on State and private lands. Visitor use would increase slightly over Proposed Action levels, but remain lower than the current level of use.

Visual impacts to the land would be reduced due to lower levels of mining activity and reclamation of post-1981 disturbances on federal claims. Impacts due to decreased water quality would continue.

The total number of mines within the watershed would decrease from 65 to 32 (51%) over the next decade. Mining expenditures, total output, mining employment, total employment, mining income, and total income would also decrease by 51%.

Validity exams on all properly filed federal claims would cost the BLM approximately $2,700,000 to complete, and the estimated net present value of all the federal claims is between $16,200,000 and $452,250,000 (Appendix B-3).

Components	Worst Case Scenario
Number of Mines	250 mines operating annually
Acreage Disturbed	25,000 acres total mining disturbance (3,000 ac. old tailings and 22,000 ac. new disturbance)
Acreage Reclaimed	13,500 acres to Proposed Action performance standards
Topography	No significant impact
Minerals	No significant impact on development
Soils:	
-Acres of soil disturbed	25,000 acres cumulative disturbance
Water Resources:	
-Channel morphology miles	62.5 miles annual disturbance
-Sediment load tons	14,600 tons per day discharge during extreme precipitation events
-Toxic substances	Magnitude unknown, heavy metal and petroleum products
Landcover:	
-Permanently barren from mining	14,885 acres
-Years to regrow to shrub community	30 to 50 years
-Threatened & endangered plants	None expected
Wildlife:	
-Acres of habitat permanently lost	1,350 acres due to permanent roads
-Acres of habitat disrupted	223,000 acres due to roads and trails
-Acres of habitat lost for x years	25,000 acres for 30 to 50 years
-Acres of habitat physically altered	26,350 acres total (roads and mined acreage)
-Threatened & endangered animals	No significant impact
Aquatic fauna:	
-Miles of habitat disturbed	62.5 miles annual disturbance
-Fish populations	Significant short term impact to local populations
Cultural & paleontological resources	No significant impact
Subsistence	Continuation of a significant restriction to subsistence uses
Recreation & visual resources	Continued reduction in visitor use; however, access to area is improved
Economics: local	
-Mining expenditures	Expenditures, output, employment, & income would change by about +385%, see Appendix B-4
-Mining employment	
-Mining income	

Figure 2-8. Summary of Worst Case Scenario.

BIRCH CREEK

Chapter III
Affected Environment

Section Page

3.1 Geology and Topography............3 – 7
3.2 Mineral Resources............3 – 13
3.3 Soils............3 – 18
3.4 Water Resources............3 – 20
3.5 Landcover............3 – 28
3.6 Wildlife............3 – 36
3.7 Fisheries............3 – 40
3.8 Cultural Resources............3 – 44
3.9 Subsistence............3 – 54
3.10 Recreation and Visual Resources............3 – 59
3.11 Economics............3 – 66

CHAPTER MAPS

Placer Mining Operations Map
Placer Claims Map
Caribou Range Map
Dall Sheep Range Map
Raptors Map
Moose Range Map
Fisheries Map
Subsistence Maps
Recreation Map
Visual Resource Map

Introduction

This chapter profiles the environmental resources in the Birch Creek drainage within the Steese National Conservation Area. It is not intended to be an encyclopedic description, rather it discusses the physical, biological, social, and economic resources and conditions that would change under the implementation of the Proposed Action or an alternative, and thus may aid a reader in understanding the alternatives.

Three of the required elements (Areas of Critical Environmental Concern, farm land, and wilderness) listed in Chapter One (Section 1.8) were not discussed or analyzed in this chapter because such resources do not exist within the affected area. A fourth element, Air Quality, is only discussed here in the introduction.

There is currently no quantitative information on air quality for this watershed. Because there are few industrial operations or cosmopolitan centers in the area, it is assumed the only pollutant sources are fugitive dust from travel on gravel roads, forest fires, and localized smoke from cabins. Occasional large forest fires in Interior Alaska can cause short-term air quality problems such as reduced visibility and discomfort over large areas. In general, however, the air quality in the area is assumed to be excellent, on observational evidence. Under all alternatives there are no anticipated long-term or cumulative impacts to the air quality in the area. Very localized deterioration of air quality will occur in the immediate vicinity of internal combustion engines employed by mining other activities. Dispersion of exhaust will quickly make levels of pollution undetectable.

General Considerations and Interrelationships Among Geology, Soils, and Sediments

The intent of this section is to briefly consider those geologic properties and controlling processes that occur at or near the earth's surface. What should be appreciated in particular are the interrelationships among physical substrates, erosion, and the properties of soils (Section 3.3) and other surficial materials, as well as the relationships to other aspects of the environment. Mineral resources (Section 3.2) are an additional fundamentally related concern.

The set of processes collectively known as erosion involve the detachment and transport of materials from place to place on and adjacent to the land surface. These processes are active in different areas and at different rates, depending on such factors as the mechanical strength of materials, climate conditions, local geology and topography, and vegetation.

Erosion, as used here, includes both the movement of products by the transport agents, and their temporary or permanent deposition. Water, particularly streams, is the most important transport agent. The products of erosion are transported in streams as dissolved load, suspended sediment, and bedload.

These natural processes have various effects. For example, continual natural erosion replenishes the stream gravels necessary for a viable fishery. However, some mining practices tend to enhance erosion processes. Accelerated erosion is caused by exposure of soil and by loss of vegetation cover, with a resultant decrease in the ability of the soil substrate to naturally regenerate. Additionally, deposition of the eroded materials may occur in places where it is unwanted and/or in excessive volumes, especially in streams where it can adversely affect downstream resources and uses. Disturbance or removal of permafrost may, locally, enhance biological productivity, although such actions also encourage erosion.

Because of these various effects, it is desirable to avoid or control mining practices that accelerate erosion, or at least to ameliorate their effects. Erosion may be divided into two general types, here termed surface erosion and mass movement.

Surface Erosion

Surface erosion refers to the movement of individual soil particles in response to gravity and/or fluid flow. It includes:

1) **Dry ravel:** movement of dry soil particles.

2) **Ice movement:** slow movement as a result of growth and melting ice needles.

3) **Rainsplash erosion:** displacement of particles due to the impact of raindrops.

4) **Sheetwash erosion:** movement due to shear stress exerted by a thin layer of water flowing over the ground.

5) **Gullying:** erosion of rills in previously unchanneled slopes.

These processes are usually minor in vegetated or undisturbed lands, although storm spikes or snowmelt runoff may overwhelm the ability of the lands to accommodate the water and may temporarily increase surface erosion. Surface erosion becomes important when land is disturbed either by nature (wildfires, landslides) or by human activities such as mining or road construction.

Mass Movement

Mass movement is a general term for a group of processes by which a fairly large volume of earth is moved at various rates of speed under the influence of gravity. A fluid may or may not be involved, but rates of occurrence and velocities are usually increased by the presence of a fluid. Mass movement is generally caused by long-term weathering and reduction of strength, but individual occurrences are usually caused by environmental events such as heavy rainstorms. There are several kinds of mass movement processes:

1) **Rockfall and rockslides:** the rapid movement of bedrock.

2) **Creep:** the slow movement of the soil mantle in response to gravitation.

3) **Slump-earthflow:** the rotational movement of a block of material along a slip surface.

4) Debris avalanche: a shallow mass failure that moves rapidly down steep hillslopes by falling, sliding, flowing, or some combination thereof.

5) Debris torrent: a highly erosive mixture of slurry, rock, and organic debris that moves down a defined channel. Such torrents can scour steep channels to bedrock, undercut valley sides, and deposit large piles of rock and mud downstream and in alluvial fans. Annual breakup results in the same type of effects.

Under natural as well as disturbed conditions, mass wasting processes are, in the short-term, the most significant means of erosion in terms of environmental considerations. Debris torrents are perhaps the most important erosional agent because of their long reach, their ability to damage downstream structures and resources, and the long periods required for channel recovery.

General Soil Properties

Soil characteristically consists of a layer of organic material underlain by several layers or "horizons" of mineral soil. The properties of each horizon vary as a result of the interplay of soil-forming factors; in particular climate, vegetation, and topography. These act on the parent material over time.

Weathering of rock-forming minerals at the earth's surface is the first step in soil formation. Chemical weathering along with physical weathering form the more stable clay minerals, concentrate iron and aluminum oxides, and release the major plant nutrients such as potassium, phosphorus, and sulfur. This contributes to the solute composition of the soil water, and ultimately of groundwater and streamwater.

Soil fertility and its contribution to productivity depend upon the physical, chemical, and biological properties of soils.

Soil Physical Properties

Soil physical properties control the drainage and availability of soil, water, and air to the root zone, affecting both root growth and nutrient movements. Physical soil properties include texture, structure, and density. Texture refers to the relative abundance of sand, silt, and clay-sized particles in the soil, and is often used as an approximate indicator of potential vegetation productivity. Structure is the spatial arrangement and bonding together of soil particles, and is important to drainage, aeration, and erosion resistance. Density refers to the soil's relative compactness, and is important to root distribution and water retention.

Vegetation and related soil biological processes are very important to the development of soil physical properties. Development of soil organic matter contributes to water-holding capacity, maintains aggregate stability, and improves soil resistance to erosion. This organic matter is a main energy source for the micro- and macroorganisms that play an active role in controlling both chemical and physical soil properties. Any change in the quality or quantity of vegetation, air temperature, water regime, or a host of other environmental variables will cause a change in soil physical properties.

The most direct changes to physical properties caused by mining practices are probably compaction or change in the soil's bulk density, and direct disruption of the structure.

Soil Chemical Properties

Soils are generally composed principally of some 15 chemical elements. Of these, seven (iron, calcium, potassium, magnesium, phosphorus, sulfur, and manganese) are important plant nutrients derived from soil weathering.

Soil chemical properties can be affected by any mining practice that tends to change the dissolved ionic composition of the soil water. Of particular concern are removal of nutrients or losses which exceed replenishment, as well as persistent changes to processes that control rates at which soil nutrients are made available to plants.

Soil Biological Properties

Soil biology generally refers to the organisms that inhabit the soil. Most contribute to beneficial processes such as weathering of parent material, soil aggregation, organic matter decomposition, nitrogen transformation and fixation, retention of other substances that would otherwise be lost by leaching, and protection of roots from pathogens.

Growth and activity of soil organisms are affected by water, temperature, aeration, acidity, food supply, and biological factors. In undisturbed lands, populations of soil organisms reach a dynamic equilibrium; seasonal changes occur, but annual populations are relatively stable. Major site disturbances upset this equilibrium.

Human activities such as mining practices, as well as various natural events may affect these processes through physical soil disturbance and modification or removal of vegetation.

Sedimentation

A recent publication by Woodward-Clyde Consultants, prepared for the Fish and Wildlife Service (FWS 1980) presents the results of a detailed five-year study of the effects of gravel removal (in many respects similar to many placer mining operations) from arctic and subarctic floodplains in Alaska. This work collected and analyzed data from 25 sites in terms of six disciplines: river hydrology and hydraulics, aquatic biology, terrestrial ecology, water quality, aesthetics, and geotechnical engineering. As stated in this report:

> "Data Analysis compared the Physical Site Characteristics (drainage basin size, channel width, channel configuration, channel slope, and stream origin) and the Gravel Removal Area Characteristics (type of gravel removal method, location of gravel removal, and age of the gravel removal site) with the measured effects of mining activities.

> "The general conclusion reached was that proper site selection and project design facilitate gravel mining with minimal effects on the habitats and fauna of floodplains. The key to the successful mitigation of potential detrimental effects is to carefully match the material site design and operation (site location, configuration, profile, schedule, and rehabilitation) with the Physical Site Characteristics of the selected floodplain."

Some other points brought out by this study which are of general relevance to the concerns of the present EIS include the following:

> "Sedimentation
>
> "Sedimentation includes the processes of erosion, transportation, and deposition of sediment. These are complex processes related to sediment and water flow properties. Attempts to quantify these processes provided, at best, estimates of the quantity....
>
> "Sediment Size Distribution. An important factor influencing most sedimentation on problems is the size distribution of the sediments. The typical descriptors of the size distribution of sediment are the median diameter and graduation coefficient of the material....
>
> "The median sediment size in the floodplain generally decreases in the downstream direction along a river. Thus, the median size may be cobbles in the headwaters and fine gravel near the mouth. However, the median size can significantly vary around this general average within a small area at a specified point along the river. This variation is a consequence of the variation in hydraulic forces from one point in the floodplain to another....
>
> "Channel Erosion. Channel erosion in rivers is generally considered to be either local erosion (scour) or degradation. Both result from an increase in the sediment transport capacity, or a decrease in the sediment load entering the area, or both.
>
> "Local scour is most commonly a result of local increases in velocity due to flow obstructions or contractions. The increased velocity increases sediment transport capacity. Degradation can result if the channel bed is steepened in a short reach by, for example, a meander cutoff. The sediment transport capacity would be increased through this reach causing erosion and a general upstream progression of the steepened slope.
>
> "The progressive erosion continues upstream until equilibrium is reached. In theory, equilibrium is reached when the slope is equal to the slope prior to the occurrence of the cutoff, which would require the steepened slope to migrate to the headwaters. In practice, the steepened slope is reduced during its upstream migration and gradually reaches an equilibrium condition. However, the degradation may extend over a long reach before equilibrium is achieved.
>
> "Sediment Transport. Sediment transport is the movement of sediments past a specific cross section of a river. The sediment may be transported as suspended load or bed load. Suspended load is sediment that is transported long distances suspended in the water column. Bed load is sediment that is transported by saltation (bouncing), or by rolling or sliding along the river bed.

The sediment size distinction between bed load and suspended load varies with variations in discharge. At low flows, assuming the sediments were available, silts and clays may be transported in suspension and sands and gravels transported as bed load. During floods, suspended load may include clays, silts, sands, and gravels, with cobbles and boulders transported as bed load. Often, the suspended load is assumed to include clays, silts, and sands and the bed load includes gravels, cobbles, and boulders....

"Changes in sediment transport due to gravel removal were difficult to evaluate. A few possible changes...were suggested by the sedimentary features in and around the material sites.... Long-term increases in suspended load were implied at sites with disturbed areas which contributed fine materials to the flow. Examples of such long-term increases were...access road degradation...(a) diversion dam..., and several sites with overburden piles or berms containing fine-grained materials. Similar increases in suspended load could occur from accelerated bank erosion at the site. Deposition of fine-grained sediments in several of the gravel removal areas was also observed. Sites with changes in suspended load showed no pattern with the physical site or gravel removal area characteristics.

"Apparent changes in bed load were observed at some sites in the form of gravel dunes or loose gravel deposits in and downstream from the gravel removal area. When these deposits occur in the gravel removal area, they could indicate the inability of the flow through the area to carry the sediment load delivered to it or generated within it. Deposition occurring downstream from the gravel removal area would imply that the flow through the area is sufficient to erode the loose gravel from the gravel removal area. It is possible that when these gravels reach the main channel they are transported in the form of another bed form or possibly in suspension. Bed load changes occurred most often at scraped sites in active and high-water channels, and in locations immediately adjacent to such channels.

"Ice Characteristics

"Ice jamming can occur during breakup when ice floes moving down the river are blocked, thereby blocking subsequent ice floes and eventually creating a surface dam to the flow of ice. Ice jams can cause scour due to increased velocity beneath the ice dam; they can also cause the water level to rise, resulting in increased flooding. Ice jams are normally caused by a constriction in the channel width or depth, a reduction in flow velocity, or manmade structures in the floodplain.

"Aufeis is defined as areas of ice which have developed by a sequence of events of overflowing water on top of the previous ice surface. The general mechanism for the growth of aufeis involves an increase in the hydrostatic pressure due to a reduced flow area; when the pressure exceeds the elevation of the ice surface, overflow onto this surface results and subsequently freezes. The overflow causes the pressure to decrease and ice surface elevation to increase. This sequence continues to repeat until the source water cannot produce sufficient pressure to exceed the elevation of the ice surface. Three requirements for the formation of aufeis are given

> by Carey (1973); 1) significant ground water or under-ice flow, 2) growth of ice to the channel bed or near the bed, and 3) subsurface constriction such as bedrock, less pervious soil, or permafrost."

The purpose of substantive mitigation and reclamation is to minimize harmful impacts, insofar as feasible, of any surface-disturbing activities, including placer mining operations. BLM management of such activities focuses on this. A BLM-Alaska technical publication (DOI 1987d), "Surface-Disturbing Activities in Alaska: A Guide to Technical Aspects of Mitigation and Reclamation" deals with this; the work presented by Woodward-Clyde (FWS 1980) served as a very useful conceptual and data source for parts of this BLM report.

3.1 Geology and Topography

The Birch Creek watershed study area lies within the Circle, Fort Yukon, and Charley River quadrangles, as mapped at a scale of 1/250,000 by the USGS.

Much of the following discussion in this Section and Section 3.2 is based on and/or has been freely excerpted from several key references. These are "The Alaska Mineral Resource Assessment Program: Background Information to Accompany Folio of Geologic and Mineral Resource Maps of the Circle Quadrangle, Alaska" (USGS 1987a), maps and text of USGS Open File Report 83-170-A,B,C (USGS 1983) on the Circle quadrangle, "Mineral Assessment of the Lime Peak - Mt. Prindle Area, Alaska" prepared by the State of Alaska, Division of Geological and Geophysical Surveys (ADGGS 1987), "Alaska Regional Profiles: Yukon Region" (Selkregg 1974), and "Administrative Report on the Mineral Resource Assessment for Part of the White Mountains National Recreation Area," prepared for the BLM by the U.S. Geological Survey (USGS 1987b). These references include extensive lists of previously published information, and should be consulted for this purpose, as well as for more detailed discussions of the geology, topography and mineral resources of the study area. Included as Appendix C-1 is a generalized version of the geologic time scale, for reference purposes.

The major portion of the Birch Creek watershed lies within or adjacent to the Steese National Conservation Area (SNCA). This is part of the Yukon-Tanana Upland physiographic province, which is a semi-mountainous area in east-central Alaska, bounded by the Yukon and Tanana Rivers. The study area contains a variety of topographic features. From its headwaters in the Mastodon Dome (elevation 4,418 feet) and Porcupine Dome (4,915 feet elevation) region, the main stem of Birch Creek flows generally southward, then eastward, then northward, some 344 miles to its eventual confluence(s) with the Yukon River in the Yukon Flats, (elevation approximately 400 feet). In the upper reaches, the surrounding terrain is semi-mountainous, with relief generally of 1000- 1600 feet, decreasing in the lower reaches. Birch Creek debouches onto a relatively high segment of the Yukon Flats southeast of Circle Hot Springs in the Medicine Lake area, at an elevation of about 1000 feet, and then meanders northward past the Steese Highway crossing and on to the Yukon Flats proper. Major tributaries in the upper reaches of Birch Creek include Eagle Creek, Twelvemile Creek, Harrington Fork, Clums Fork, Harrison Creek, Portage Creek, and the South Fork of Birch

Creek. Crooked Creek is a major tributary, joining Birch Creek in the Medicine Lake area, east of the town of Central. Crooked Creek has its headwaters on the north side of the divide (Mastodon Dome - Porcupine Dome area) separating it from the headwaters of Eagle Creek - Birch Creek. Mertie (1938) notes that "The drainage pattern of Birch Creek is rather striking. The main stream heads against one of its own tributaries and flows southwest, then east, then north, and finally, outside of the Circle District, it flows northwest for many miles parallel to the Yukon and joins that river in the Yukon Flats, downstream from the settlement of Beaver. Crooked Creek, one of the tributaries of Birch Creek, which in its lower course occupies the central part of the lowland area... has a fan-shaped headwater drainage area, against which the main Birch Creek heads." Preacher Creek, with headwaters to the southwest in the Mt. Prindle area (elevation 5,286 feet), is also a tributary to Birch Creek, joining it to the north on the Yukon Flats proper, south of Birch Creek Village.

Topographic relief along Birch Creek, across the Yukon Flats terrain, is generally quite low, less than 200 feet. The Yukon Flats area encompasses the region where the Yukon River reaches farthest north and turns southwest. The central part of this area consists of marshy, lake-dotted flats, rising from some 300 feet in elevation in the west to 600-900 feet in the north and east. Rolling silt and gravel-covered terraces, with sharp escarpments 150 to 600 feet high, rise above the flats and slope gradually upward to elevations of some 1,500 feet at the bases of surrounding uplands and mountains. The area is drained by the Yukon River, which has a meandering course with many sloughs southwest of the bend at Fort Yukon. Thaw lakes are abundant throughout the flats and, together with sinks, are common on the marginal terraces.

The Yukon Flats are underlain principally by unconsolidated to semi-consolidated alluvial fan, terrace, and lake sediment deposits. Portions of the Flats may also be underlain at greater depths by appreciable thicknesses of Cenozoic sedimentary rocks. The Pleistocene-Recent age deposits of alluvial fans, terraces, floodplains, and dunes that form the surface of the Yukon Flats are known to extend to at least 148 feet in depth at Fort Yukon. These deposits are underlain by more than 290 feet of silt and silty sand of late Tertiary to early Quaternary age (Williams 1962).

The Yukon Flats lie within the zone of discontinuous permafrost, in which the unconsolidated deposits and the bedrock are characterized by intermittent unfrozen zones, which occur chiefly beneath waterbodies and well-drained sites, as well as by layers of unfrozen deposits within the pervading permafrost. The depth of permafrost has been ascertained to be as much as 320 feet at Fort Yukon, but may in fact be much deeper in the region (Williams 1962).

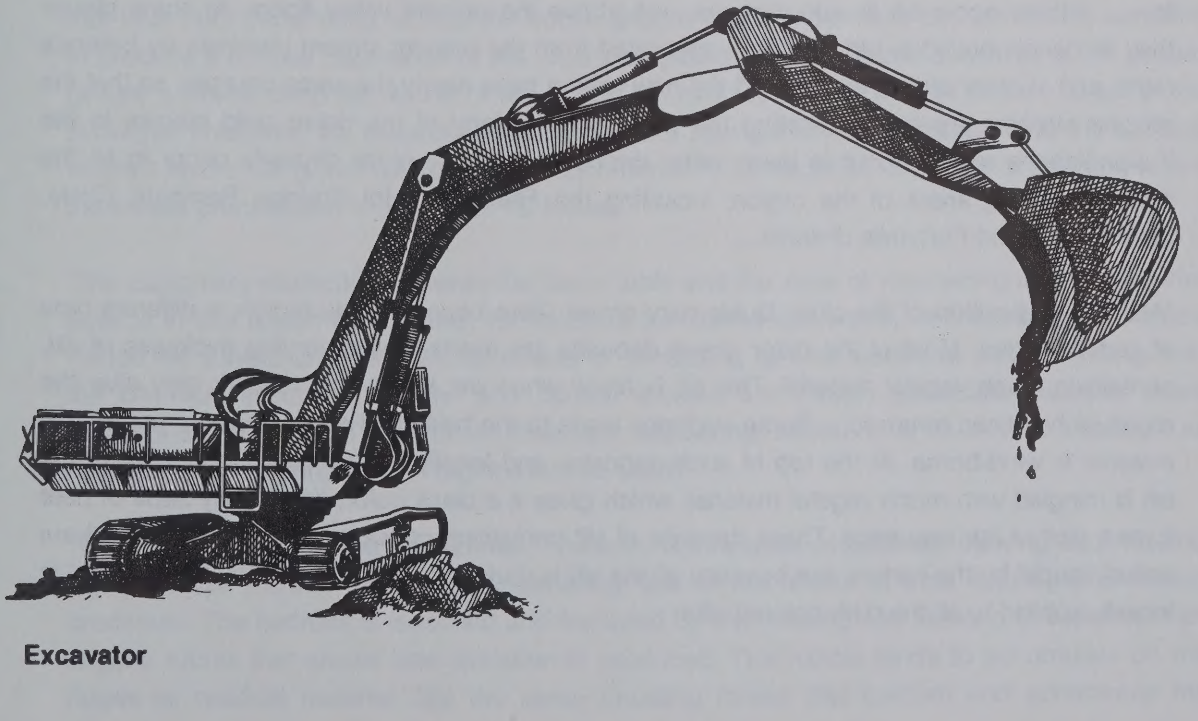
Lying between the Yukon and Tanana Rivers, south of Yukon Flats, is the Yukon-Tanana Upland. Rounded ridges and gentle slopes characterize the topography. In the study area these ridges trend generally northeast to east, have ridge crest elevations of 1,500-3,000 feet, and rise 500-1,500 feet above adjacent valley floors. The ridges are surmounted by compact, rugged mountains of 4,000 to 5,286 feet in elevation. Valleys are generally rather flat, alluvium-floored, and one-fourth to one-half mile wide, to within a few miles of the headwaters.

The portion of the study area outside of the Yukon Flats is made up geologically of a variety of bedrock types, which are juxtaposed structurally in a moderately complex manner. The principal disruptive structural features include major thrust faults, as well as strike-slip faults related to the Tintina Fault Zone. The Tintina Fault Zone, mentioned previously, is a very large-scale zone of faulting, of regional extent (hundreds of miles in surface-length), and of fundamental significance to the overall geologic framework of Interior Alaska. A portion of this zone extends along a northwest-southeast trend across the northern part of the study area. The bedrock underlying the portion of the study area outside of the Yukon Flats ranges from Precambrian to Tertiary in age, and consists of quartzitic, pelitic, calcic, and mafic metasedimentary rocks, as well as some mafic and felsic metaigneous rocks. These have been extensively intruded by younger (Mesozoic and Cenozoic age) magmas which resulted in the formation of appreciable amounts of granitic rocks, as well as minor amounts of intermediate and mafic igneous rocks.

Prominent topographic features in the study area include Mt. Prindle, Porcupine Dome and Mastodon Dome, mentioned previously, as well as Pinnell Mountain (4,721 feet elevation), Table Mountain (4,472 feet), Far Mountain (4,694 feet), and Ketchem Dome (3,535 feet).

Although these upland areas are neither exceptionally high nor really extensive, there is evidence of Pleistocene glaciation, particularly in the higher elevations. As summarized by Pewe, et al (1967): "The Yukon-Tanana Upland consists of an extensive area of rounded hills and ridges several thousand feet high. The higher mountains, comprised of granite and gneiss, and 4,000 to 6,700 feet in elevation, have been carved and steepened by glacial erosion. The dendritic drainage pattern of the area is controlled by a northeastward trend of the bedrock structures.

No glaciers are present today, and although perennial snowbanks may exist on the higher mountains, none have been observed. Altiplanation terraces (large flat areas) occur in step-like fashion on ridges and mountain tops, at elevations slightly lower than the adjacent glacial cirques. Active



Excavator

solifluction is common on the slopes, and patterned ground is well developed on the altiplanation terraces. Permafrost is present in the valley bottoms and north-flowing slopes to depths as great as several hundred feet. Cirques, U-shaped valleys, moraines, and outwash plains, all of two distinct geomorphic ages, indicate that at least two major alpine glaciations occurred in the Yukon- Tanana upland of Alaska. Although several hundred cirque and valley glaciers were present during each glaciation, only 3 to 5% of the upland was glaciated."

During the Pleistocene, large volumes of water discharged from these glaciers in the mountains caused modification of the topographic features at lower elevations, by erosion as well as depositional processes. Large amounts of outwash material, principally gravels, were deposited in low-lying areas, particularly along principal drainage courses. Some of these gravels contain economically valuable minerals, in particular gold. In some appropriate positions along the drainages natural concentrations (placer deposits, ie.) were formed. Such deposits have been recognized throughout the study area. These outwash gravels of old floodplains subsequently were covered by reworked silt and organic materials. The resultant topography is rather flat, the ground is poorly-drained and is presently frozen at least in part, with visible ice-wedge features in many places. Such permafrost conditions are pervasive throughout the Yukon- Tanana Upland, since the entire Interior Alaska region is within the zone of discontinuous permafrost (Williams 1970). Specific relationships concerning permafrost in any given site depend on a complex array of geologic and topographic factors.

Mertie (1937) discusses the nature, distribution and origins of the various Pleistocene - Recent surficial deposits recognized within the Yukon-Tanana Upland:

> "...earliest Pleistocene deposits consist of silt, sand, and gravel ... These deposits occur in many different sites in the present valleys. Some of them lie 200 feet or more below the present surface.... Others occur on stream terraces, well above the present valley floors. At some places they lie deeply buried in old channels, separated from the present stream channels by bedrock reefs; and at other places the old and the new valleys have nearly the same courses, so that the present streams are now dissecting the older gravel. Many of the richer gold placers in the Yukon-Tanana region occur in these older deposits .... These older deposits occur in all the principal mining areas of the region, including the Fairbanks, Hot Springs, Rampart, Circle, Seventymile, and Fortymile districts....
>
> "After the deposition of the older Quaternary gravel there began, in this region, a different type of sedimentation. Most of the older gravel deposits are overlain by a varying thickness of silt, containing much vegetal material. This silt is black when wet but is light to dark gray after the moisture has been removed.... Some evidence leads to the belief that a considerable part of this material is wind-borne. At the top of such deposits, and locally in layers throughout them, the silt is mingled with much vegetal material, which gives it a black color; and locally beds of peat form a part of the sequence. These deposits of silt containing considerable vegetal material are called "muck" by the miners; but because all the silt is dark colored when wet the term "muck" is loosely applied to all the dark-colored silts.

"These silt deposits, as well as the gravel below them, are usually frozen in whole or in part, in Interior Alaska. The silt, however, is much more likely to be solidly frozen than the gravel. It also contains beds and lenses of clear ice, practically free of sediment, which are believed in large part to have formed after the original deposition of this material. These beds of silt in some localities are only a few feet thick, but in other places, as in the Fairbanks district, they may have a thickness of 100 feet or more. The silt beds are not uniform in character throughout, for mining has shown the presence of them in inlaid lenses of grit or even gravel, showing that conditions of alluvial accumulations were by no means uniform, even at any one locality. Such deposits, overlying the older gold-bearing gravel, present one of the great difficulties of placer mining in Interior Alaska. The silt itself is practically barren of gold, and in order to reach the underlying placers this overburden must either be removed, or else underground mining methods must be utilized....

"The Recent alluvial deposits are composed mainly of gravel, sand and silt. Much of the coarser debris has been eroded from bedrock sources and laid down by the present streams. The silt has been derived in considerable measure from the reworking of the older silt, although a certain proportion has also been deposited by recent streams. Certain solifluxional processes peculiar to sub-Arctic regions have also tended to produce fine sediments of this type....

"Stream detritus originates largely by mechanical and chemical weathering of the regional bedrock, but in Interior Alaska the relative importance of these methods is modified by local conditions. Chief among these are the low mean annual temperature and the vegetation. The mean annual temperature of the Yukon-Tanana region is about 9° below freezing, which alone is capable of producing a condition of permanent frost in the subsurface. In addition to this, the valley floor and sides and also the ridge tops up to an elevation of 3,000 feet are covered with a mantle of mosses and other vegetation, which act as an insulator and tend to prevent the summer heat from penetrating far into the frozen ground below. And these two conditions combine to produce a curious disposition of the local precipitation, for the frozen condition of the deeper ground prevents deep circulation of water, and the mosses prevent a rapid surface runoff of the rainwater. Therefore, the moisture is conserved in a spongelike mossy mat close to the surface, where it favors the growth of vegetation much denser than might be expected in a region where the annual precipitation is only 11 or 12 inches.

"The customary distinction between the water table and the zone of weathering above the water table is in this region hardly valid, for much of the subsurface water, where present, is frozen. Hence the solvent and depositional effects of circulating ground water are almost lacking, and the chemical effects of oxygen and carbon dioxide are sharply restricted, because these reagents are not carried in solution. Chemical weathering, therefore, is much less important as an agent of weathering than in regions farther south.

"The surface of the ground in summer, however, is in a state of alternate thawing and freezing that produces marked mechanical weathering, due to the effects of frost heaving and related processes. The bedrock is loosened and fractured by the freezing and thawing of water, and an angular rubble that shows little oxidation is produced. This rubble tends to accumulate on the ridges as residual material. But the same thrusting forces that fracture and comminute the bedrock are also effective as a means of transportation, for the rock debris is thrust upward and laterally away from its place of origin and begins to move slowly down the hill slopes into the valleys below. Such moving sheets of alluvial material often develop characteristic flow lines along the sides of the valleys so that they resemble successive waves on a shallow body of water....

"Although chemical weathering in the headwater regions of the streams is sharply restricted, and mechanical weathering is seasonal, nevertheless the total amount of debris that is moved by the processes above outlined is remarkably great. It is not uncommon to observe sheets of such alluvial material impinging from both sides of a valley upon a headwater stream at a rate faster than the stream can transport the material downstream, so that the stream tends to flow in a narrow channel, sometimes several feet deep and only a foot or two wide; and in places the lateral debris has actually coalesced over the running water. This residual and semiresidual material is unsorted and includes rock fragments of all sizes, embedded in fine silt. Where the alluvial sheet has moved laterally a considerable distance from its place of origin to a drainage channel, the angular debris becomes rounded to a considerable degree. As soon as this material is exposed to the effects of running water, it begins to move downstream, the silt rather rapidly, especially in times of flood, and the larger rubble more slowly. From this stage onward, however, the erosional processes are essentially similar to those that prevail in more southern latitudes, and the results are essentially the same. The headwater gradients are normally steeper than the gradients of the lower valleys, and at some point or rather some zone in the valley stream action changes from transportation to deposition. As the regional relief is reduced and the headwater gradients are diminished, this zone of deposition moves upstream, thus developing progressively upstream a fluviatile gravel sheet. As the upper part of the gravel sheet is extended upstream, finer sediments cover the lower part, with the final result that the coarser and heavier sediments form the base of the alluvial section. The uniformity of this process is interrupted by floods, which carry coarse material farther downstream than it would ordinarily go and deposit it on top of finer material, thus resulting here and there in alternating beds of fine and coarse material. This general process of stream alluviation is also modified by local conditions....

"Another condition that modifies the character of the Recent alluvial deposits is the effect of winter ice.... In some of the smaller streams the ice increases greatly during the winter, both in thickness and in area, as a result of overflows of water, acting under hydrostatic pressure from upstream. Such bodies of ice do not move downstream in the spring with the normal winter ice but are dissected by the streams and often remain as valley ice, or "aufeis", nearly all summer. Such deposits of aufeis also have the effect of widening valley floors, for in spring, when the water first begins to flow, channels may be cut along the sides of the ice, thus diverting the stream against the valley walls and producing lateral erosion. Many stretches of wide flat valley floor on the tributaries of the Yukon have been produced in this manner, and it is quite possible that the same process, acting on a larger scale during the glacial epoch, may have been a powerful accessory factor in the development of the Yukon Flats."

3.2 Mineral Resources

The USGS has investigated the geology and mineral resources potential of major portions of the study area as part of studies of the Circle and Livengood quadrangles (USGS 1983 and 1987a, b), while the State of Alaska carried out related work in the Lime Peak - Mt. Prindle area (ADGGS 1987).

"The geologic setting of the Circle quadrangle, especially the presence of post-orogenic plutons intruded into regionally metamorphosed rocks, is similar to regions, such as eastern Australia, southwestern England, northern New England, and southeastern Canada, that contain tin vein/greisen deposits, tungsten skarn deposits, lode gold deposits with associated placers, and uranium deposits hosted by peraluminous granites. The presence of very small bodies of ultramafic rocks would permit the occurrence of chromite, nickel, and asbestos deposits, although supporting geologic and geochemical evidence for such deposits has not been found within the quadrangle." (USGS 1983).

Additional work by the State of Alaska (ADGGS 1987) has further substantiated the potential for mineral deposits featuring tin, silver, tantalum, tungsten, uranium, rare-earth elements, and gold in bedrock environments in the Lime Peak - Mt. Prindle area. Probabilistic estimates were made for lode mineral resource potential in this area by comparing various attributes of the observed geology, geochemistry, and mineralization with similar, well-studied mining districts worldwide. This methodology gives a range of potential resources at various levels of certainty. The results indicate that three-quarters of the potential mineral resource is in tin-silver deposits, and about one-quarter is in gold deposits. The quantitative estimates suggest a fair probability (50%) that the Lime Peak-Mt. Prindle area contains as much tin and silver as moderate-sized producing tin districts worldwide (320,000 tons of tin, and about 10 million ounces of silver - a gross metal value of $3 billion at current commodity prices). A small probability (5%) exists that the study area contains three times that amount of tin and silver. Approximately two-thirds of the tin-silver endowment is associated with six prospect areas in the Lime Peak pluton. The remainder of the endowment is distributed through other parts of the Lime Peak pluton, the Quartz Creek pluton, and the Mt. Prindle pluton. The bulk of the uranium and rare-earth potential is confined to the syenite intrusions at the western edge of the Lime Peak-Mt. Prindle area. At a 50% probability, the syenites would contain at least 250 tons of uranium and 520 tons of rare-earth elements (approximately $40 million current gross metal value). Lode gold endowment is mostly restricted to a belt along the southern part of the Lime Peak-Mt. Prindle study area, and is present primarily in quartz-tourmaline vein-associated occurrences and alkalic igneous rock-related deposits, with a small contribution from stratabound deposits and skarns. Most of the lode gold endowment potential is in large volume, low-grade, disseminated and vein- aggregate deposits. Gold content of the favorable areas at the 50% probability level is equivalent to a large Alaska gold district (1.5 million ounces, $675 million current gross metal value). A low probability (5%) exists that the ADGGS study area could contain ten times as much gold.

The Circle quadrangle has been an area of gold placer mining since the 1890's. Cobb (1984) documents placer gold occurrences on 27 creeks in the Circle Mining District, a sub-area within the Circle quadrangle. The placer deposits recognized to date occur in several sub-areas within the Birch Creek watershed study area (USGS 1983). One such sub-area includes Clums Fork, Lawson, Munson, and Volcano Creeks, tributaries to Birch Creek from the south. These creeks were mined in the 1970's and 1980's. Volcano Creek may have been mined much earlier. The stream valleys in this sub-area are narrow and contain small volumes of gravel, relative to other portions of the study area. Another sub-area includes streams of the Circle mining district proper. Gold has been produced here since the late 1890's. The main productive streams include Bonanza, Butte, Deadwood, Eagle, Gold Dust, North Fork of Harrison, Independence, Ketchem, Mammoth, Mastodon, Miller, Porcupine, and Portage Creeks. Deadwood Creek was dredged briefly in the 1930's; Mastodon Creek was dredged during two periods between 1912 and 1926. The upstream and peripheral parts of many streams in this sub-area are presently being mined, or have been mined in the recent past. The most productive streams appear to have been those which drain metamorphic bedrock near Mastodon Dome. Another sub-area near the town of Central includes a sedimentary basin which may contain buried placer gold deposits and possibly sediment-hosted uranium deposits. It is a fairly large area with relatively little mining known along the modern streams, although Crooked Creek is presently being mined for placer gold.

Placer deposits in the study area have been the source of mineral commodities other than gold as well. Both cassiterite (tin ore) and wolframite (tungsten ore) have been sold as by-products from Deadwood Creek. Other valuable or noteworthy minerals found in placer concentrates include cinnabar, alloyed platinum, magnetite, ilmenite, garnet, zircon, pyrite, scheelite, pyrrhotite, and other

C.P. GIBS, OPEN, CUT, MINING ON 5 BELOW PEDRO CREEK
Huey Foto

Early Interior placer mining operation. Photo courtesy of Anchorage Museum of HIstory and Art.

sulfide minerals, as well as uranium and rare-earth minerals (Cobb 1973). A diamond was recovered from a placer mining operation on Crooked Creek in 1982, and a few more have been reported since. Two of these diamonds were reported to be of 0.3 and 1.4 carats size. Although no bedrock source for these diamonds has been identified yet, the possibility exists that the study area could contain placer and/or lode diamond deposits.

The study area also contains sources of crushed stone, and sand and gravel, at least sufficient for local uses.

3.2.1 Mining in the Study Area

Gold was first reported in the Birch Creek area in 1862, but it was an 1893 discovery that established the Circle Mining District. By 1896, upper Birch Creek and its major tributaries had been prospected and mining was under way. Mining activity in the drainage has been continuous with a break for World War II.

Mining activity began to grow again in the mid-1970's with the increase in gold prices, and by 1978 the Circle Mining District was the most active in Alaska. "In the 1980's, between 500-1000 miners in as many as 80 operations utilized the resources of upper Birch and its tributaries" (Oakes 1987). Since the mid-1980's, the number of miners and operations have dropped to approximately 65 operations employing over 200 people [Alaska Placer Mining Applications (APMA) (ADNR 1987) and BLM compliance reports (DOI 1987c)].

The most complex issue confronting the miner is compliance with the State of Alaska and EPA water quality standards. Two other issues affecting miners in the Birch Creek Watershed are: 1) the permits the COE issue, and 2) the outcome of pending litigation and this EIS. Resolution of these issues is progressing, and delay will probably contribute to the reduction of mining operations within the drainage.

Water quality standards in some form have been in effect for placer mining for over ten years. EPA began issuing National Pollutant Discharge Elimination System (NPDES) permits in 1976 and has changed the permit requirements several times since then (Hagler, Bailly and Company 1987). Permits have required various mine effluent limitations for settleable solids and turbidity, and over the years requirements have become more stringent.

Nevertheless, Alaska's placer mining industry was growing in the late 1970's due to increases in the price of gold. Although water quality standards were in effect, enforcement of mining water discharge standards was nonexistent or minimal at best, and many miners operated without employing wastewater treatment techniques. By the early 1980's, it became obvious to the State of Alaska that water quality of mined streams was suffering and that the then current mining practices were not adequate to meet the water quality standards. To evaluate and attempt to resolve the problem, the Alaska Department of Environmental Conservation (ADEC) and other State agencies initiated numerous studies of placer mining's potential effects on the aquatic environment. They also sponsored projects to develop and field test wastewater treatment techniques.

One of the first field projects, a 1981 study on settling ponds, revealed that "the effluent from placer mines typically does not meet all State and federal water quality standards. The standards for turbidity and arsenic were almost never met and the standard for settleable solids was met with various degrees of success. The pH and temperature standards were met most of the time, and the standard for dissolved oxygen was met all the time" (ADEC 1982). Seven of the nine study mines with settling ponds met the settleable solids standards.

Follow-up studies and projects have shown that properly designed and operated settling ponds can effectively remove settleable solids, allowing compliance with the settleable solid standard. These studies have also shown that arsenic and mercury are effectively reduced to non-hazardous levels with simple settling of mine effluent (EPA 1987a). Knowing the value of effective settling ponds, miners began constructing and using ponds to treat their mine discharge water, and by 1987 most mines met the settleable solid limitation of 0.2 ml/l (EPA 1987a; Hagler, Bailly and Company 1987; and observations of BLM mine inspectors, DOI 1986b and 1987c).

Meeting the effluent turbidity limitations has proven to be more difficult than meeting the settleable solids standard. Simple settling is not effective to meet the turbidity requirement (EPA 1987a), so other techniques have been tried to reduce turbidity to acceptable levels. These techniques included classification, clean water bypass, recycling mine water, tailing filtration, and coagulation/flocculation. The first four techniques worked well to reduce water used in the mining process or the amount of effluent discharged and helped to improve the overall water quality of the receiving stream. Although these treatment techniques helped to improve water quality, the effluent discharge still was not in compliance with the standards.

The last treatment listed, coagulation/flocculation, involves mixing chemicals with mine process water. The chemicals react with sediment particles suspended in the process water, causing them to fall out of suspension. This treatment must be tailored to each mining operation and requires technical expertise to select and design an application system (ADEC 1987a). Unfortunately, such systems have not consistently produced mine effluent in Alaska that meets the water quality standards, and the long-term cost of such a system is somewhat uncertain (ADEC 1987a). Given these circumstances, few mine operators are willing to invest time and money into a system that cannot ensure compliance, especially if their current operation is not cited for noncompliance of turbidity standards. The State and EPA have not rigorously enforced this standard at most mine locations (Hagler, Bailly and Company 1987). However, where the State has focused enforcement of these water quality standards, such as the Chatanika River (a priority stream), the overall water quality of the stream or river has improved.

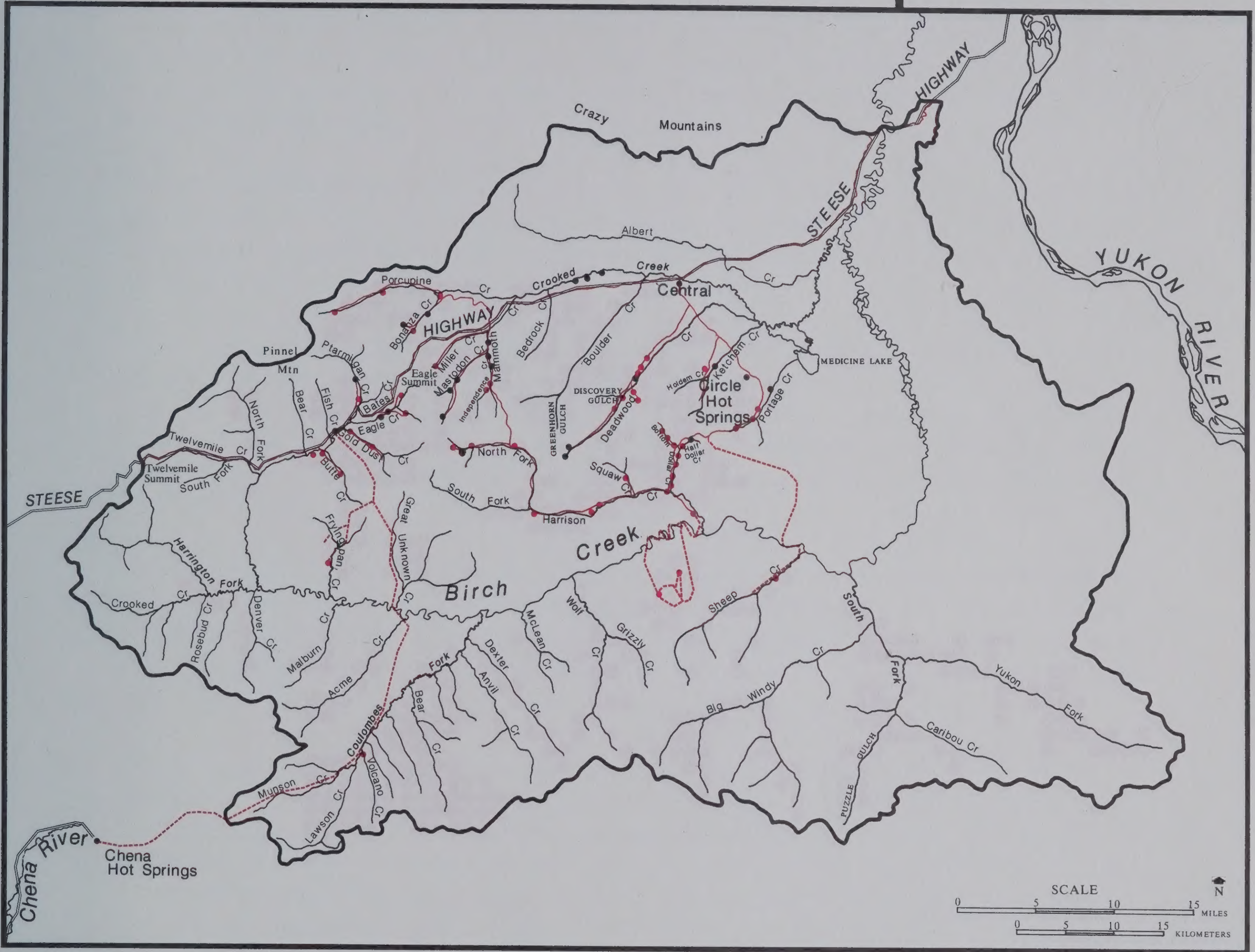
Beginning in 1988, the COE will require miners to obtain authorization for work involving the discharge of dredged or fill materials into waters if the United States, including wetlands. This requirement is not new, but few miners have obtained these permits in the past. Reclamation standards may be similar to those currently required of federal operators. Meeting reclamation standards to comply with various requirements may increase costs for some mine operations.

Birch Creek **Placer Mining**

DRAFT

Cumulative Environmental Impact Statement

Placer Mining Operations and Access Roads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Porcupine Cr
Bonanza Cr
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Mastodon Cr
Miller Cr
Independence Cr
Eagle Summit
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Ptarmigan Cr
Bates
Eagle Cr
North Fork
Bear Cr
Fish Cr
Cr
Twelvemile Cr
Twelvemile Summit
South Fork
STEESE
Gold Dust Cr
Butte Cr
North Fork
South Fork
GREENHORN GULCH
DISCOVERY GULCH
Deadwood Cr
Holdem Cr
Ketchem Cr
Circle Hot Springs
Portage Cr
MEDICINE LAKE
Bottom Dollar Cr
Half Dollar Cr
Squaw
Harrison Cr
Birch Creek
Fryingpan Cr
Great Unknown Cr
Harrington Fork
Crooked Cr
Rosebud Cr
Denver Cr
Malburn Cr
Acme Cr
Wolf
McLean Cr
Grizzly Cr
Sheep Cr
South Fork
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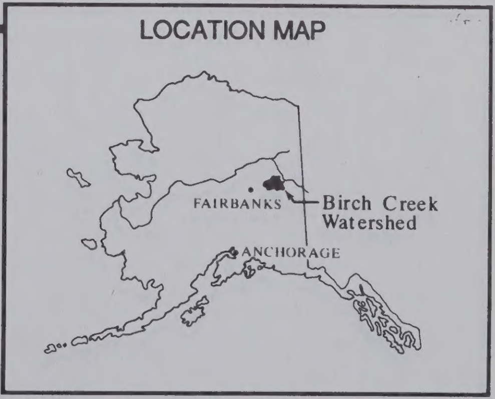
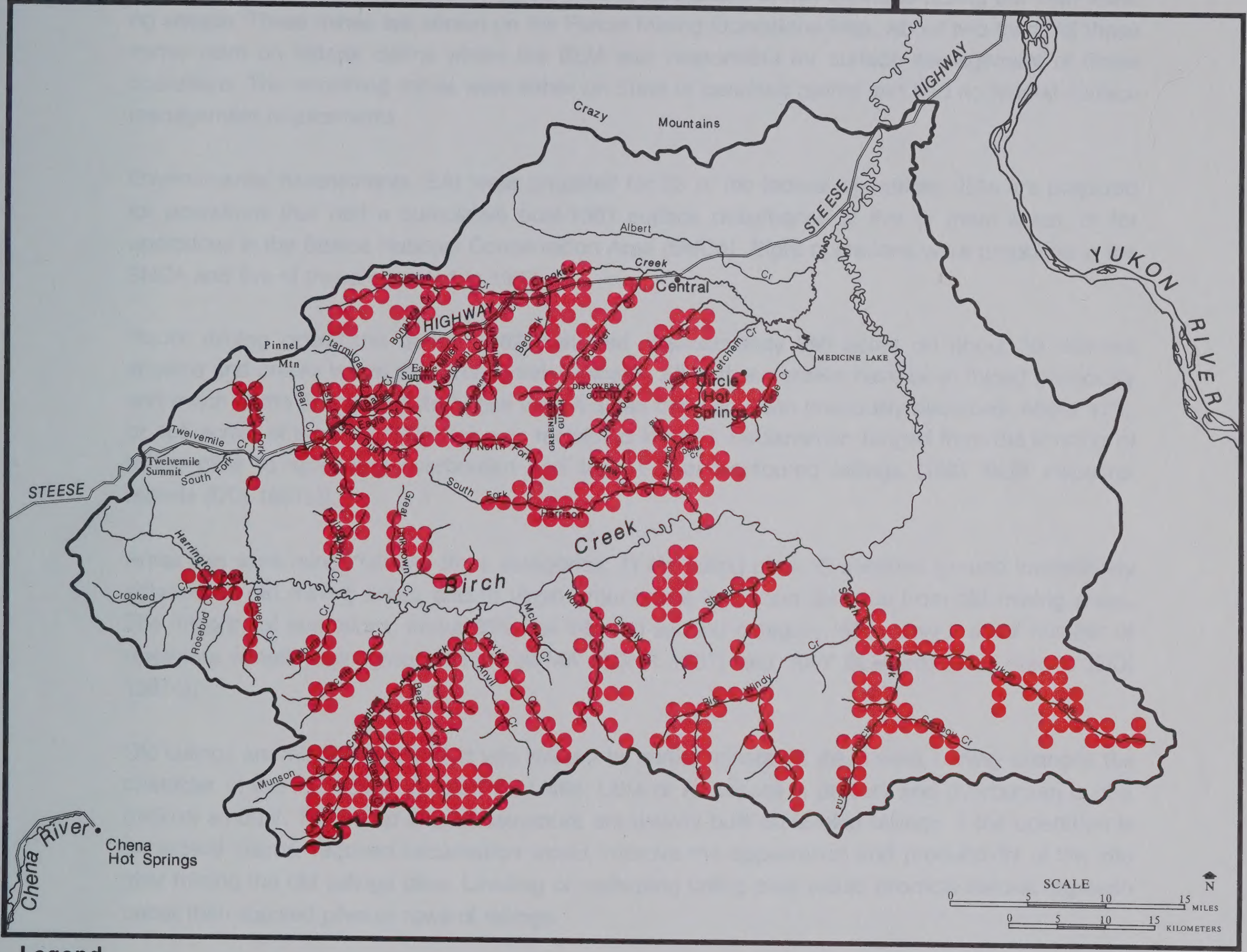
Legend

- • Federal 1987 Operations*
- — Permanent Access
- - - - Winter Trail
- • State 1987 Operations*


LOCATION MAP
FAIRBANKS
Birch Creek Watershed
ANCHORAGE

*The operations depicted above include only those active State and Federal claims for which Annual Placer Mining Applications were filed for the 1987 field season.

Placer Claims


Crazy Mountains
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Pinnel Mtn
Ptarmigan
Bonanza
Eagle Summit
Mastodon
Mammoth
Bedrock
Boulder
Ketchum Cr
MEDICINE LAKE
Circle Hot Springs
DISCOVERY GULCH
GREENHORN GULCH
Bear
Twelvemile Cr
Twelvemile Summit
South Fork
North Fork
STEESE
Harrison
South Fork
Great
Creek
Birch
Harrington
Crooked
Rosebud
Deadwood
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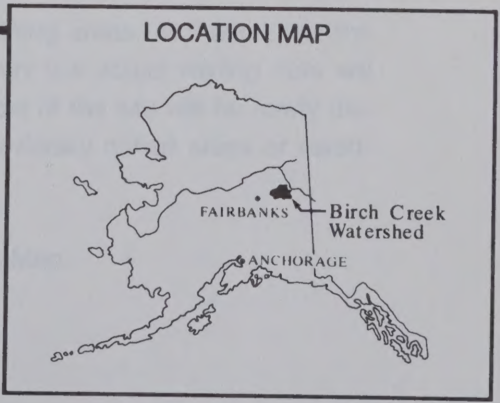
Legend

● Federal placer claims shown active on BLM records.
One dot may represent more than one claim.


LOCATION MAP
FAIRBANKS
Birch Creek Watershed
ANCHORAGE

3.2.2 Active Mines

There were approximately 65 active placer mining operations in this drainage during the 1987 mining season. These mines are shown on the Placer Mining Operations Map. About two-thirds of these mines were on federal claims where the BLM was responsible for surface management of those operations. The remaining mines were either on State or patented claims and had no federal surface management requirements.

Environmental Assessments (EA) were prepared for 25 of the federal operations. EAs are prepared for operations that had a cumulative post-1981 surface disturbance of five or more acres, or for operations in the Steese National Conservation Area (SNCA). Eight operations were proposed in the SNCA and five of those operated in 1987.

Placer mining operations during 1987 disturbed approximately 590 acres on about 30 different streams and creeks within the Birch Creek drainage. All of these creeks have been mined previously and much of the 590 acre disturbance was in areas that had been previously disturbed. About 17%, or 100 acres, of the disturbed area was reclaimed in 1987. Reclamation ranged from the leveling of tailing piles to spreading overburden and topsoil over contoured tailings (1987 BLM inspector reports (DOI 1987c)).

Areas that were mined fall into three categories: 1) old tailing piles, 2) unmined ground immediately adjacent to old mining areas, and 3) virgin ground that is a short distance from old mining areas. The majority of operations, about 85%, fall into the second category, while only a small number of operators mined virgin ground (1987 APMA (ADNR 1987) and 1987 BLM inspector reports (DOI 1987c)).

Old tailings are mined for gold that was missed by earlier miners. At these sites, mining changes the character of the immediate location very little. Little or no topsoil is present and overburden is of a minimal amount. The camp and infrastructure are usually built on leveled tailings. If the operation is on federal claims, required reclamation would improve the appearance and productivity of the site after mining the old tailings piles. Leveling or reshaping tailing piles would promote natural regrowth better than stacked piles or rows of tailings.

In 1987 most operators were mining new ground adjacent to old mining areas. At these sites, the operational area is primarily on previously disturbed ground and only the actual mining cuts will cause new surface disturbance. In the few areas of virgin ground, most of the site will be newly disturbed ground; however, access to the site will probably be over previously mined areas or established roads or trails.

The general locations of these claims are shown on the Placer Claims Map.

3.3 Soils

There are four broad soil associations within the Birch Creek watershed (U.S. Soil Conservation Service, 1979). These associations are only general descriptions of the specific soil types that may occur and have only been identified through interpretation of vegetation patterns from aerial photography. There may be considerable variation in the specific soil properties within each association. All of the soils in the area are cryogenic or soils that have formed under cold conditions and show cold soil temperatures. Due to the seasonally cold temperatures, the entire Yukon - Tanana region is underlain by discontinuous, moderately thick to thin permafrost. Pewe (1982) describes permafrost as:

> "...naturally occurring material with a temperature colder than 32° F for at least two years. Permafrost is defined exclusively on the basis of temperature.... Most permafrost is cemented by ice, but permafrost without water, and thus without ice, is termed dry permafrost. The upper surface of permafrost is known as the permafrost table. In permafrost areas, the layer of ground that freezes each winter and thaws each summer called the active layer -- varies in thickness according to its moisture content. Generally, this thickness is from one half to one foot in wet, organic sediments and up to six to nine feet in well- drained gravels.... When the mean annual air temperature drops below 32° F, ground frozen during the winter may not completely thaw in the summer, and a layer of permafrost may form. This layer may continue to thicken below the seasonally frozen ground. The thickness of the permafrost layer is controlled by the balance between the mean annual air temperature and the geothermal gradient. As the climate becomes colder or warmer -- but the mean annual temperature remains below 32° F permafrost thicknesses correspondingly increase or decrease by changes in the position of the base and top of the frozen ground. These changes depend not only on the amount of climatic fluctuation, but also on the amount of moisture in the ground and on the combination of geologic factors that in part control the geothermal gradient. Thus, if the geothermal gradient and mean air temperature are known, and if the surface temperature is stable for a long period of time, it is possible to predict the thickness of permafrost in areas remote from water bodies.... Permafrost is essentially a phenomenon of polar and subpolar regions. About 20% of the world's land is underlain by permafrost. Perennially frozen ground is most widespread and thickest in northern regions of the northern hemisphere.... (Approximately) 82% of Alaska (is) underlain by permafrost.... Perennially frozen ground is 2,000 feet thick in northern Alaska and progressively thins to the south. In the northern hemisphere, perennially frozen ground is differentiated into two broad zones of lateral continuity: the continuous permafrost zone and the discontinuous permafrost zone. In the continuous zone, permafrost is present everywhere except under lakes and rivers that do not freeze to the bottom. The discontinuous zone includes numerous permafrost-free areas that progressively increase in size and number from north to south."

The four general soil associations in the Birch Creek watershed are:

3.3.1 The Typic Cryochrepts Soil Association

This association occurs extensively in the uplands of Interior Alaska and constitutes the major soil association in the Birch Creek drainage. It occurs on high rounded ridges and hills and valley side slopes typical of the Tanana hills region. Elevations can range from 1,000 to 3,500 feet and can occasionally exceed 4,500 feet. These soils have developed from a variety of parent materials. On the hills they have formed from material weathered from the local bedrock. In the valleys they have formed from deep loamy sediment washed from the surrounding uplands. These soils are almost universally underlain by permafrost.

The vegetation patterns for this association are dictated mainly by the patterns of permafrost. On the south-facing slopes where the permafrost table is deep or occasionally absent and the soils are well drained, the vegetation consists mainly of white spruce, aspen, and paper birch. At the higher elevations the soils are covered by alpine shrubs, grasses, lichens, mosses, and forbs. On north-facing slopes where the permafrost is continuous and shallow, the vegetation is mainly black spruce with an understory of mosses, tussocks, and low shrubs.

The soils in this association are generally not suitable for cultivation and present severe construction or engineering restrictions. There are only limited areas suitable for commercial forestry or cultivation of vegetable crops. Those areas are located in the bottom of broad valleys where slopes, if disturbed, remain stable. Disturbance of the insulating vegetative mat on these soils can result in severe erosion. When this mat is disturbed or removed, the underlying permafrost begins to thaw and the loamy texture of the soil is susceptible to rapid erosion. On sideslopes this erosion can appear as gullying, mudslides, slope failures, and other forms of mass movement. In level areas the thawing can produce thermokarsts, which are areas of local subsidence resulting from the thawing of underground ice. Thermokarsts can become quite large and may eventually become lakes or ponds.

3.3.2 The Pergelic Cryaquepts-Pergelic Cryochrepts Soil Association

This association occurs on steep unglaciated hills and mountains in the Interior highlands. Most of the soil types have developed above treeline from very gravelly or flaggy colluvial material weathered from the local bedrock. Elevations range from 1,000 to 5,000 feet with some mountain peaks over 6,000 feet. The soils in this association are predominantly poorly drained, and ice-rich permafrost occurs on north-facing slopes.

Soils at the higher elevations and in well-drained areas at lower elevations are covered by a layer of sparse, shrubby vegetation. The highest elevations can develop patterned ground features such as solifluction lobes, stone stripes, and frost boils. At the lowest elevations and in natural waterways, the vegetation consists of a mixed white spruce/birch/aspen forest. Soils which are dominated by permafrost at shallow depths, such as on the north-facing slopes, support black spruce and sedge tussocks.

Soils in this association are too cold and steep for cultivation and support only very limited harvesting of commercial timber. These soils present severe restrictions for road location, building sites, or off-road trafficability.

3.3.3 The Lithic Cryorhtents Soil Association

This association occurs in the high mountainous regions of the area. Characteristically, the topography is very rough with deeply dissected valleys and sharp rocky ridges. Soils at the higher elevations are too shallow for permafrost to develop, but it can occur at the lower elevations. In this area the soils occur at elevations of at least 5,000 feet.

The highest areas are barren of vegetation or support a sparse cover of alpine tundra. The lower elevations and the valley bottoms support a shrubby vegetation, with black spruce forest at the lowest elevations.

These soils are too steep and cold, and occur at elevations too high to support any cultivation or forestry. The steep slopes and occasional permafrost severely restrict construction or engineering within these soils.

3.3.4 The Histic Pergelic Cryaquepts Soil Association

This association is found in broad sloping or level uplands at elevations ranging from 1,000 to 3,000 feet. Soils in this association are almost universally underlain by shallow permafrost. Most of the soils have formed from thick, silty, colluvial material weathered from the local bedrock.

The dominant vegetation consists of sedge tussocks, mosses, and occasional stands of black spruce. There is generally a thick mat of old organic material directly above the first mineral layer of the soil. All of the soils in this association present severe restrictions for any intensive use or development. Due to silty texture and extensive ice-rich permafrost, they are very susceptible to thermal and fluvial erosion if disturbed. These soil types are not suitable for either agriculture or forestry purposes.

3.4 Water Resources

3.4.1 Interrelationships and Overview

Water enters the watershed in three primary ways: as precipitation, intercepted atmospheric moisture, and condensation. Some of this water adheres to the leaves and branches of vegetation and is either adsorbed, drips to the vegetated floor, or evaporates.

Precipitation reaching the vegetated floor contributes first to surface storage on the vegetated litter, or it is ponded in depressions, or held in the snowpack. It then infiltrates the soil or runs off as overland flow. Water infiltrates, flows laterally, and eventually surfaces as streamflow.

Infiltrated water is detained temporarily by the soil as it percolates toward groundwater or streams, but a portion is retained, eventually to be evaporated or transpired. The amount of water retained and available for use by vegetation depends on soil density, structure, depth, and organic matter content. Evapotransportation is related to the regional climate and to the microclimate as controlled by local slope, aspect, elevation, and vegetation.

Yield is defined as water not evaporated, transpired, or retained by the soil to satisfy future evapotranspiration needs. It includes both surface runoff as the streamflow, and subsurface losses to groundwater. Streamflow is the product of input (precipitation) minus loss (evapotranspiration, contribution to groundwater aquifers, and the capacity of the soil to store water).

While it is generally apparent that water exerts a major control over vegetation, vegetation has some control over water. Natural or human-caused modification of the vegetative cover has the potential for affecting all segments of the hydrologic cycle such as:

1) The distribution of water and snow on the ground.

2) The amount of water intercepted or evaporated by foliage.

3) The amount of water that can be stored in the soil or transpired from the soil by vegetation.

4) The physical structure of soil, which governs the rate and pathways of water movement to stream channels.

In turn, any of these changes can have a major effect on streamflow. Streamflow characteristics potentially altered by human activities such as placer mining, as well as natural events such as wildfire or loss to disease, include annual yields and peak flows.

Atmospheric moisture contains dissolved gases and chemical ions, including some caused by human activities. Generally, precipitation has a low dissolved ions content, and streamflow quality is largely determined by the remainder of the ecosystem. Water quality variables of concern include stream temperature, dissolved substances, and suspended sediment.

Stream temperature is controlled by exposure to direct solar radiation and the temperature of inflowing tributary or ground water. Stream temperature may be affected by practices which remove shade from streamside areas or alter channel morphology.

Aspects of concern regarding the chemical composition of stream water include acidity, inorganic cations and anions, and organic substances. The chemical constituents and acidity are controlled principally by mineral weathering in the parent materials and soils.

The sediment load of a stream (both suspended and bedload) is determined by such characteristics of the drainage basin as soils, vegetation, precipitation, topography, and land use. The estimated 1987 sediment loads for the Birch Creek drainage are shown in Figure 3-1. Sediments enter the stream system by a variety of erosional processes. To achieve stream stability, an equilibrium must be sustained between sediment entering the stream and sediment transported through the channel. Human activities such as mining, as well as natural events which change sediment loading can upset this balance and result in physical and biological changes in the stream system.

	1987				
Category	**Annual Tonnage Rate of sediment per square mile**	**X**	**Square miles of a category in Birch Creek**	**=**	**Annual Tonnage Rate of sediment per category in Birch Creek**
Forest	24	X	1,926.00	=	46,224
Abandoned Surface Mines	2,400	X	4.81	=	11,544
Active Surface Mines	48,000	X	0.92	=	44,160
Construction	48,000	X	2.1	=	100,800

Figure 3-1. Methodology used to obtain annual tonnage sediment rates for various categories in Birch Creek. Square mile sediment rates taken from EPA.

Water yield is the final product of the hydrologic cycle and reflects water-soil-vegetation interactions. Of concern are such runoff characteristics as the amount and temporal variations, and quality as indexed by temperature, dissolved constituents, suspended sediments, and bedload.

> "Bank erosion and turbidity in Birch Creek and its tributaries has probably been quite consistent throughout the history of the area. In recorded history, these factors have been observed in several forms: natural erosion due to the water action; erosion and turbidity due to spring runoff and frequent flash floods during the summer season, usually following thunderstorms; mining and commercial activities; and the '100- year flood' of 1967, a single event which changed the courses and banklines of the Birch and its tributaries more than anything yet observed by Man. The massive force and flow of this flood cut and changed banks of the Birch and its tributaries along the entire watershed, opening areas previously sealed by vegetative ground cover to quick erosion from any activities since that time. During this flood, water levels were so high that the Birch overflowed its banks and flooded the Yukon flats west of Circle City to the point that both rivers were joined and mature birch trees floated across from the Birch channel to the Yukon. It is not unusual, in the course of an ordinary summer thunderstorm, to have the Birch and its tributaries rise several feet in less than an hour, threatening any activities along the banks and cutting transportation routes until the water level drops. Water flow and levels on the upper Birch and its tributaries are capricious for both miners and recreational users alike" (Oakes 1987).

Nonetheless, by 1973 when the draft prepared by the Bureau of Outdoor Recreation (DOI 1974) was distributed, the DEIS stated that "Birch Creek is a clear, free-flowing Interior Alaskan stream." This might suggest that over the 30-year period between the suspension of mining in World War II and this DEIS (see Section 3.8.3 for discussion of Birch Creek's extensive mining history) Birch Creek watershed restored itself from historic mining damages.

3.4.2 Basin Characteristics

Birch Creek originates in the Tanana Hills near Eagle Summit and Mastodon Dome as a high gradient, quick flowing stream. The basin is generally northeastern in aspect.

Birch Creek freezes over in the late fall and can be expected to support vehicles by mid-November. During at least some winters Birch Creek freezes solid, creating as much as 12 feet of ice. The river remains frozen until spring breakup, generally around mid-May.

The precipitation in the Birch Creek drainage varies widely, due to the topography. Precipitation is generally greater in the headwaters at higher elevations than in the lower reaches in the Yukon Flats. Precipitation also varies with the season, with 60% to 70% occurring during the period June through September, and normally peaking in July. Precipitation information for Circle Hot Springs, located roughly mid-basin, is presented below in Figure 3-2.

The average precipitation for the station at Circle Hot Springs is 10.29 inches per year. Lacking other data, this is assumed to represent total precipitation for the watershed. The distribution of precipitation is expected to be similar throughout the basin with the headwaters receiving correspondingly higher amounts, and the "flats" to the north receiving somewhat less. Average snowfall in the area is approximately 50 inches per year, with 20 inches (4.1 inch water equivalent) remaining in April prior to break-up.

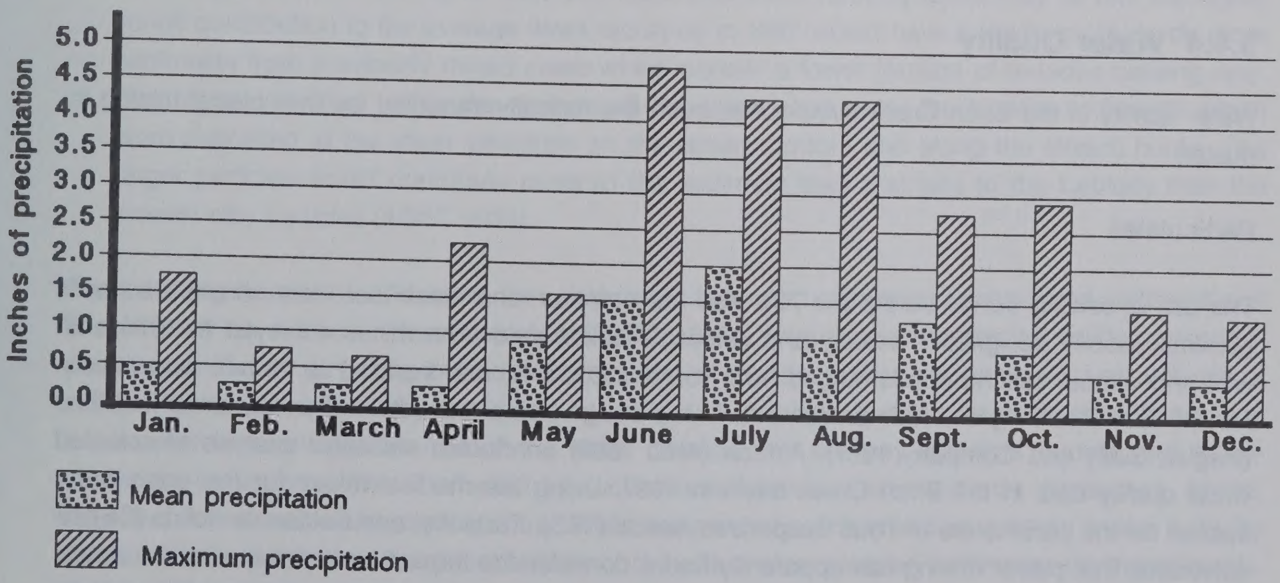


Figure 3-2. Precipitation at Circle Hot Springs.

Although extensive data have been collected on the water quality in the Birch Creek system, the amount of information on stream flow is sorely lacking. The USGS monitored the streamflow of Birch Creek at the Steese highway bridge in the early 1900's. There have been occasional measurements and staff gauge estimates of flows in the watershed since then. Streamflow of Birch Creek at the Steese Highway bridge can be expected to range from 4,500 cfs (June) to 500 cfs (October) during the summer months with an average of around 1,500 cfs. During the winter months discharge can drop to zero (Vogler, unpub. data). Discharge from the many tributary streams into Birch Creek is highly variable. These smaller streams generally freeze solid in the winter. Groundwater discharge into many of them create large aufeis areas 12 or more feet thick. The peak stream flow for these tributaries usually occurs during the spring breakup period. However, due to the influence of permafrost and the impermeable or saturated ground conditions, and the lack of surface storage in the upper basin, large floods can occur in response to heavy summer storms. Intense thunderstorm activity generating an inch or more of precipitation can cause localized flooding in the smaller drainages. Larger storm systems can generate 2.5 or more inches of rain (Weather Bureau 1963) creating flooding in the lower reaches of Birch Creek.

3.4.3 Water Uses

The major industrial water use in the area is for placer mining operations and support facilities. Most of this use is non-consumptive and the waters are eventually returned to the stream system. Domestic water users in the area include the residents of Central and Circle Hot Springs who obtain the majority of their water from wells. The villagers of Birch Creek, downstream on the Yukon Flats, obtain their water either from Birch Creek or surrounding natural waterbodies. Additional uses include recreational river running on the segment of Birch Creek which has been designated as part of the Wild and Scenic River system. Sport fishing occurs on tributaries not directly affected by placer mining.

3.4.4 Water Quality

Water quality in the Birch Creek system has been dramatically impacted by the placer mining industry.

Particulates

The use of settling ponds during the 70's was not common and those that were constructed were generally poorly designed. Turbidity and settleable solids data from mines surveyed in 1976 both with and without settling ponds ranged from 150 to 1,200 NTU and from 1.2 to 13 ml/l respectively. Miners have made significant improvements in the design and construction of ponds since that time (Hagler, Bailly and Company 1987). Aldrich (AHC 1988) conducted statistical analysis of selected water quality data in the Birch Creek basin in 1987. Using the median values for the open water season for the parameters of Total Suspended Solids (TSS), Turbidity, and Settleable Solids (SS) he concludes that placer mining has apparently had a considerable impact on water quality. He notes, however, a wide variability in the data due to differences in the type of mine operation, the material being mined, the type of sediment controls employed and the number and size of mines on a stream. Further, he indicates the possibility of biases in the data base due to data collection techniques. The data indicate an inverse relationship between mining impacts on water quality and the distance from mining activity. This is due primarily to the effects of increased settling of sediments with increasing distance and decreasing gradient, and the effects of dilution from clear water tributaries. Aldrich continues by indicating that since 1983 the impacts of placer mining in the drainage are decreasing at most sites sampled. This trend is notable at most of the sites analyzed and is apparently not due to natural changes such as the distribution of rainfall and runoff.

Analysis of water quality parameters from the three stations located below mining that were sampled between 1983 and 1986 indicates that turbidity was probably higher than allowed by State water quality standards. Turbidity values at Birch Creek Village in 1987 probably exceeded 26 NTU less than 20% of the time, while at the stations above Twelvemile Creek and at the Steese Highway the values were exceeded more than 65% of the time. There are insufficient data to assess the sources of the turbidity during the 1987 season. However, data gathered during 1986 shows that on streams unaffected by recent mining, turbidity exceeded 26 NTU 3% of the time. This would indicate that a portion of the turbidity is attributable to natural causes.

The DEC in their 1987 Annual Mining Report discuss the 1986 and 1987 levels and sediment loads of Birch Creek. As stated in the report:

> "The Birch Creek drainage received 25% more runoff in 1987 than in 1986. Turbidity levels decreased in 1987 from the 1986 average and median levels. Sediment loads increased from 1986 to 1987. Sediment load represents the amount of material transported by the waterway. It is likely that the reduction in turbidity levels can be attributed to a reduction in point source sediments due to improved sediment loads, however, may be a result of reclamation activities, ponds washing out, and erosion from the unvegetated, disturbed areas.
>
> "One explanation for the higher sediment loads and lower turbidity levels may be that the higher runoff contribution to the average flows recorded in 1987 would have a tendency to erode more sediments from previously mined areas which contain a lower fraction of turbidity-causing clay. The higher velocities within the stream will resuspend and carry the heavier sediments which were deposited at the lower velocities on the stream bottom and along the stream banks. The larger particles would contribute more to the sediment load and less to the turbidity than the smaller clay particles (ADEC 1988).

The following discussion addresses the relationship between turbidity and suspended sediment and is essentially an extraction from Peterson (ADEC 1985a). Analysis of suspended solids concentrations is conducted as a gravimetric determination of the particulate matter in a given volume of water. The results are usually expressed as milligrams per liter. Turbidity, on the other hand, is a measure of the optical properties of the water column, and the way that light is deflected or absorbed by particulates. This is affected by such characteristics as size and size distribution, shape, refractive index, and absorption spectra. While suspended solids measure particle mass, turbidity measurements are more of a determination of the effect of suspended sediments on the transmission of light, and therefore, on the impact to the biological community. There is no direct relationship between these parameters, other than that they are both methods of measuring particulates. In part, due to the cost and effort required to conduct such a laboratory analysis, turbidity has been used as an indirect measure of suspended sediments.

In recent years an interest has developed in the use of flocculents as an aid in controlling the discharge of particulates from placer mines. As there has also been some concern over the possible side effects of such use as well, it is pertinent to discuss this issue here. Up to this point there has been a limited experimentation with flocculation at test mines in the Birch Creek drainage. Results indicate that such treatment may reduce turbidity to levels required by regulation. However, dosage required to attain such levels may be too costly. There is also the consideration that high dosages increase the potential of the presence of flocculents in the discharge, and consequent impacts on downstream uses (ADEC 1985a). Treatment of process waters to the 100 to 200 NTU level appears to be the most appropriate use of this technology. Most of the flocculants tested in the watershed so far (particularly PEO) are evaluated as being non-toxic. Some of the flocculants tested are used in domestic water treatment plants to remove particulates before they can enter the distribution system. However, there is some potential for the introduction of nutrients and toxicity to the stream system from the use of flocculants in treating process waters. This is largely due to the possibility of inefficient application, or the use of less refined or inappropriate chemicals. Currently the innocuous nature of flocculant composition and the scale of use in the watershed indicate that there has not been an adverse impact on the water quality from such use. As yet this technology has not been adopted for full- scale operation in the basin.

Observations by BLM (Mowatt 1987) during the summer of 1987, along the reach of Birch Creek from the Steese Highway bridge upstream for approximately one-half to one mile, indicates the presence of many massive soil and vegetal matter "clods" being transported; these were particularly numerous during high water in June. These masses appear to be derived from bankcoving/sloughing, are representative of natural erosion of the unconsolidated/semi-consolidated sediment/soil materials into which this portion of Birch Creek is presently incising itself, not likely unrelated to the mining activities far upstream. It was observed that these masses of materials were undergoing physical breakdown into constituent sedimentary particles of a spectrum of particle sizes, including appreciable amounts of very fine (clay-sized) particles, and appeared to be contributing substantially to the resuspended sediment load of this reach of Birch Creek. Since water quality measurements made to date on Birch Creek feature a sampling site first upstream of the the Steese Highway bridge, some caution must be suggested in the interpretation of such data regarding attribution of causes/sources of sediment "pollution," at least in this section of Birch Creek, as well as further downstream, where the underlying/adjacent geologic substrate is principally unconsolidated/semi-consolidated sediments.

Chemical Constituents

In general, Aldrich found that mining selectively affected water quality parameters analyzed for Birch Creek. Calcium, magnesium, phosphorus, potassium, and trace metal concentrations were increased, as was temperature. There was no effect on such parameters as dissolved oxygen, pH, or nitrates and nitrites. Concentrations of arsenic, lead, zinc, and copper are also increased below active mining in the basin (LaPerriere, Wagener, and Bjerklie 1985). They occur both as dissolved and absorbed constituents. Aldrich also notes, "...over 50% percent of the water quality samples from above recent mining exceed the 4-day average criteria for the protection of aquatic life for cadmium, copper, lead, and mercury. All of the samples from below mining also exceed the 4-day average criteria for these metals...."

Groundwater

Groundwater studies (Bjerklie and LaPerriere 1985) have determined that sediments deposited in the stream bed reduced the hydraulic contact between surface and subsurface waters and caused the piezometric surface to be below the surface water level on mined streams. Additional impacts of this isolation were cementing of the stream substrate and a significant decrease in the dissolved oxygen concentration and conductivity of subsurface waters.

Conclusions

In summary, placer mining has been shown to result in the elevation of turbidity, SS, and TSS, and the sedimentation of stream channels. A secondary effect is the resuspension of deposited sediments resulting in increased turbidities during periods of high flow. Sediment loads and deposition rates for Birch Creek have been higher than expected for a clear water tributary. It has been estimated that the normal bankfull, or two-year flood, is insufficient to remove sediments from the gravel beds, resulting in cementing of the stream channel (ADF&G 1987b). It is possible that such cementing of the stream channel can result in changes in the piezometric surface of the drainage, with perched stream beds, decrease in oxygen content and elevated conductivity levels of the groundwater, and subsequent changes in channel morphology. Mining activity has resulted in increased concentrations of some constituents, as well as transport of trace metals in conjunction with introduced sediments. Introduction of sediment to the stream system is also apparently occurring through erosion from washed-out settling ponds, unstable ground, and disturbed stream beds even when there is no active placer mining. It is not known how long these impacts continue after mining has ceased.

Hazardous Materials

Most mining operations in Alaska use only a limited variety of materials which are currently categorized as hazardous. In the Birch Creek drainage these are currently limited to fuels and solvents. The use of explosives or the chemical processing of gold-bearing ores, the other likely sources of hazardous materials in placer operations, are not anticipated within the period encompassed by this analysis. Regulations at 40 CFR 112 require that operators of facilities with fuels stored in excess of 660 gallons per single container or 1,320 gallons in aggregate prepare and implement Oil Spill Control and Countermeasures (SPCC) plans. Secondary containment, such as provided by a continuous berm or dike, is required in conjunction with the plan. The purpose of the regulation is to reduce the likelihood of a spill reaching navigable waters and to reduce the extent of damage if such a spill should occur. Operators are required to report spills entering navigable waters or adjoining shorelines to the National Response Center.

State regulations (18 AAC 75) require differing levels of response depending on the amount of hazardous material spilled. However, any spill must be reported. Ultimate disposal of hazardous substances must be approved by the Department of Environmental Conservation (DEC); however, no permit is required. While little attention has been given to disposal of solid wastes in the past, the DEC intends to require compliance with the regulations in the future. The current recommendation for such waste disposal is burning combustibles and back-hauling non- combustibles. Landfills may be permitted on a site-specific basis.

3.5 Landcover

3.5.1 Introduction

The vegetation components of an ecosystem grow in response to the elements in the environment. As discussed previously in the Soil and Water Resources sections, vegetation influences, and is affected by the complex interrelationships of biotic and physical factors. The resultant vegetative communities vary in the species present (flora), the percentage of these species (composition), the spatial and vertical arrangement of the plants (structure), and in the productivity of organic material (function).

The vegetative cover of an area is an integrated expression of historic and present conditions and disturbances. Burned areas are visible in the mosaic of vegetation patterns over 100 years after the wildfire. Riparian vegetation on floodplains results from ice-free, well-drained soils. Prostrate alpine vegetation has adapted to short growing seasons and exposure to desiccating winds throughout the year. Shallowly rooted black spruce grow on ice-rich permafrost soils. The ground cover of *Sphagnum* moss insulates soils and contributes to lowered soil temperatures which result in permafrost. Wetland communities grow in response to a high water table, and serve as a buffer to fluctuations in the water table.

Vegetation is an important component of habitat for wildlife and human populations. Vegetation is used for food and shelter by most species in the watershed. Sometimes fauna impacts the vegetation sufficiently to change the community on a site. Moose may severely overbrowse the willows of an area, beaver may flood out sedge/shrub meadows, or humans may remove the vegetation entirely for mining activities.

After various disturbances, the vegetation usually grows back on a site. A series of different communities usually replace each other as environmental conditions change. This process is called succession. The community composition and rate of change result from the severity and size of the disturbance, the soils and climatic conditions on the sites, the availability of reproductive materials, and conditions for establishment of seeds or vegetative propagules.

The distribution patterns of landcover types in the Birch Creek watershed are fairly typical of patterns throughout Interior Alaska. The mosaic of vegetation communities within the watershed has developed in response to a variety of environmental factors, including climate, physiography, surficial geology, soil character, discontinuous permafrost, and disturbances such as fire, flooding, and human actions, including placer mining. Portions of the riparian zone in the upper reaches of the Birch Creek watershed have been influenced by placer mining over the past 90 years, as have most other drainages in the Yukon-Tanana watershed.

3.5.2 Description of Vegetation Types

Most of the major landcover types typical of Interior Alaska are represented in the Birch Creek watershed (Figure 3-3). The landcover types are based on the Alaska Vegetation Classification System (Viereck, et al. 1986 and 1987). This five-level classification system is specifically designed to describe vegetation associations from a general level (Level I including forest, scrub, and herbaceous) to a detailed description (Level V, which incorporates the scientific names of the species of plants in the associations).

The upland areas of the watershed are characterized by alpine tundra types and by a diversity of forest types whose distribution is affected by such factors as slope, aspect, soils, permafrost, and repeated fire patterns. Riparian areas along stream channels on current and former floodplains and old terraces support a variety of forest, shrub,and herbaceous types in various stages of succession, dependent upon a site's history of fire, floods, and mining.

Alpine tundra and sparsely vegetated communities grow on the various domes and high country above 3,000 feet north and south of Birch Creek. The alpine tundra areas have plant associations of *Dryas* dwarf scrub, plants belonging to the ericaceous heath family; and dwarf scrub of bearberry, blueberry, and mossberry. *Cassiope* is widespread on moist alpine sites, as is willow tundra. The lichen components are variable and include fruticose and crustose growth forms.

Lower rolling slopes support communities of dwarf and low shrubs, and sedge/shrub tundra. Mixed in with the forest components are tall and low scrub communities of alder, willow, and ericaceous shrubs such as Labrador tea and blueberry, and dwarf birch. On the better-drained slopes the ground layer may be composed of herbaceous plants, mosses, and lichens such as the *Cladina* groups (reindeer moss), and some graminoids. The poorly drained and wetter slopes are characterized by more alder and some willow with a ground layer of *Sphagnum*, sedge tussocks, other mosses, and foliose lichens like *Peltigeria*. This mosaic of shrub and moss/sedge types is prevalent in the low wetlands between the Crazy Mountains, Birch Creek, and the hills south of Medicine Lake.

Tussock tundra grows on the large gentle northwest-facing slopes in the valley of Clum's Fork.

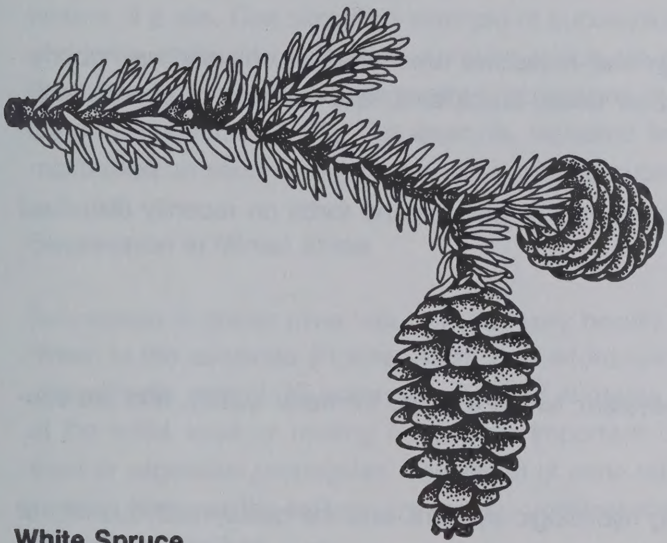
Deciduous forests occur on steeper south, west, and east-facing slopes throughout the watershed. Well-developed stands of birch may be found on silt loam ridges. Major concentrations of deciduous forests are on the north side of Birch Creek, in Big Windy and other tributaries of the South Fork, the drainages flowing north into Crooked Creek, and on the south slopes of the Crazy

LEVEL I CLASS	COMMUNITY	LEVEL IV CLASS	PLANT CANOPY DESIGNATION
Forest	Riparian	White Spruce	closed, open, woodland
	Riparian	Black Spruce	closed, open, woodland
		Black spruce-white spruce	closed, open, woodland
		Black spruce-tamarack	open, woodland
	Riparian	Balsam poplar	closed, open
	Successional	Birch	closed, open
	Successional	Aspen	closed, open
	Successional	Birch-aspen	closed, open
	Riparian	Spruce-birch	closed, open
		Aspen-spruce	closed, open
	Riparian, Successional	Poplar-spruce	closed, open
Scrub	Riparian	Tall willow	closed, open
		Tall alder	closed, open
	Riparian	Tall alder-willow	closed, open
	Riparian	Low willow	closed, open, sparse
		Low willow-alder	open
	Riparian	Mixed shrub-sedge tussocks	open
		Mesic shrub birch-ericaceous shrub	open
	Riparian	Ericaceous shrub bog	open
	Riparian	Shrub birch-willow	open
	Riparian	Willow-gramnoid bog	open
Dwarf shrub		Dryas tundra	
		Dryas sedge tundra	
		Vaccinium tundra	
		Cassiope tundra	
		Willow tundra	
Herbaceous		Midgrass shrub	
		Midgrass herb	
	Riparian, Successional	Bluejoint-herb	
	Riparian	Tussock tundra	
	Riparian	Sedge-dwarf birch tundra	
	Riparian	Wet sedge meadow tundra	
	Riparian	Wet sedge-herb meadow tundra	
		Subarctic lowland sedge wet meadow	
		Subarctic lowland sedge moss bog meadow	
		Alpine herb-sedge	
		Fresh herb marsh	

Figure 3-3. Landcover types in the Birch Creek watershed (Viereck 1986).

Mountains. Some valley slopes in the watershed were logged for firewood in the early 1900's, or have been burned by wildfires. Many of these areas are currently vegetated with dense single-aged deciduous forests.

Black spruce and low shrub/moss types grow on most of the gentle slopes in the drainage. Open black spruce and black spruce-birch stands are common on poorly-drained, cold sites on north- and east-facing slopes. These slopes are underlain by permafrost. Large stands are in the dissected mountains and lower valley slopes south of Birch Creek. Large old stands are in the lowlands north of Circle Hot Springs. Much of the lowland area has been burned within the past 100 years, and the black spruce is in a mosaic with various shrub and deciduous regrowth types.



White Spruce

Open white spruce and white spruce-black spruce stands are commonly found on the drier, well-drained south and west-facing slopes. These mix communities grow on the hills south of Birch Creek and in the Crazy Mountains. Birch, birch/aspen, and spruce/birch stands are vegetation associations which also grow on these slopes, but are successional to stands of white spruce as the climax vegetation.

The vegetation communities in the riparian zone along the stream floodplain and lowland areas of the valleys are most impacted by placer mining, and will have the greatest variation in the resultant impacts associated with the various alternatives (Section 4.5). The riparian zone along Birch Creek supports a community of white spruce and cottonwood in the lower reaches, and a community of low and tall shrubs in the upper parts of the drainage. The bottoms of creeks draining Porcupine, Mastodon, and Ketchem domes which have been placer mined are mostly barren, with some shrub regrowth.

Riparian Forest

The closed needle/leaf forest (canopy cover greater than 60%) types include white spruce along the rivers and drainages located on well-drained, permafrost-free soils; black spruce generally occurring on poorly-drained organic soils which are often underlain by permafrost; and black spruce/white spruce forests on the river terraces.

The closed broadleaf forest (canopy greater than 60%) is represented by the balsam poplar which occurs most frequently on river floodplains. There is a closed, mixed forest type of poplar/spruce which is an intermediate successional stage leading to the white spruce climax on floodplain sites.

Riparian Scrub

Tall scrub includes willow thickets which are especially characteristic of floodplains and river banks, and shrub swamps of alder and willow which occur on floodplains and in drainageways.

Low scrub stands occur in wet stream bottoms, poorly-drained lowlands underlain by permafrost, and floodplains. These communities include dwarf birch/ericaceous shrub bog, mixed shrub/sedge tussock bog, ericaceous shrub bog, shrub birch/willow, and willow/graminoid bog.

Recently disturbed gravel bars and tailings support sparse shrub communities, usually willow, alder, and balsam poplar seedlings.

Riparian Herbaceous

Wet sedge/herb meadows and lowland sedge wet meadows are common on very wet, poorly-drained sites with standing water such as oxbow lakes, floodplains, and margins of ponds, lakes and sloughs.

Another herbaceous type is the pioneering community of grasses and forbs on recently disturbed gravel bars or tailings.

Wetlands

Wetlands, an important component of the ecosystem, act as a buffer for water quality, and are subject to long-term effects after disturbances.

> "Wetlands play a major role in maintaining hydrologic systems and the quality and quantity of surface and ground waters. Some wetlands can absorb large quantities of water and act as natural flood control systems for rivers by gradually releasing floodwaters and reducing the magnitude of high flows. Wetlands may slow the rate of runoff during periods of normal rainfall and help recharge aquifers. In some places, sediments and pollutants may be filtered out of water draining through wetlands, and water quality may thus be improved. Wetlands are extremely important to resident and migratory birds for resting, feeding, and nesting and can be important foraging grounds for large mammals such as caribou, moose, and bear." (DOI et al 1987f).

Wetlands have been defined by the COE in 33 CFR 323 as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." The COE definition allows that any vegetated area which is underlain by ice-rich permafrost typically meets the wetland definition. Therefore, many areas in the Birch Creek watershed below the alpine zone are wetland in character and subject to Section 404 of the Clean Water Act. The COE definition of wetlands differs from other wetland definitions used in Alaska. These definitions are based on water saturation of the upper strata of the substrate and standing water at the surface, and such areas usually do not include all black spruce and many scrub communities as wetlands.

3.5.3 Successional Patterns

The major causes of disturbance in the Birch Creek valley are wildfires and placer mining. After a site has been disturbed, a series of vegetation communities sequentially develops, one gradually replacing its predecessor in a systematic, successive manner. The process of succession is "the more or less orderly pattern of events and processes in nature whereby plant and animal species replace each other as a result of a changing environment" (Komarek 1971). The rate of succession results from the type, frequency, duration, and intensity of disturbance, and the basic environmental factors of a site. One simplified example of succession on a site would be vegetation types of grass and forbs, replaced by deciduous shrubs, which are replaced in turn by a climax community of coniferous trees. A disclimax community is maintained in an area subject to continuous repeated disturbance (Daubenmire 1968). For example, repeated fires often cause aspen and birch stands to be maintained on south-facing slopes when white spruce would be the "normal" climax stage.

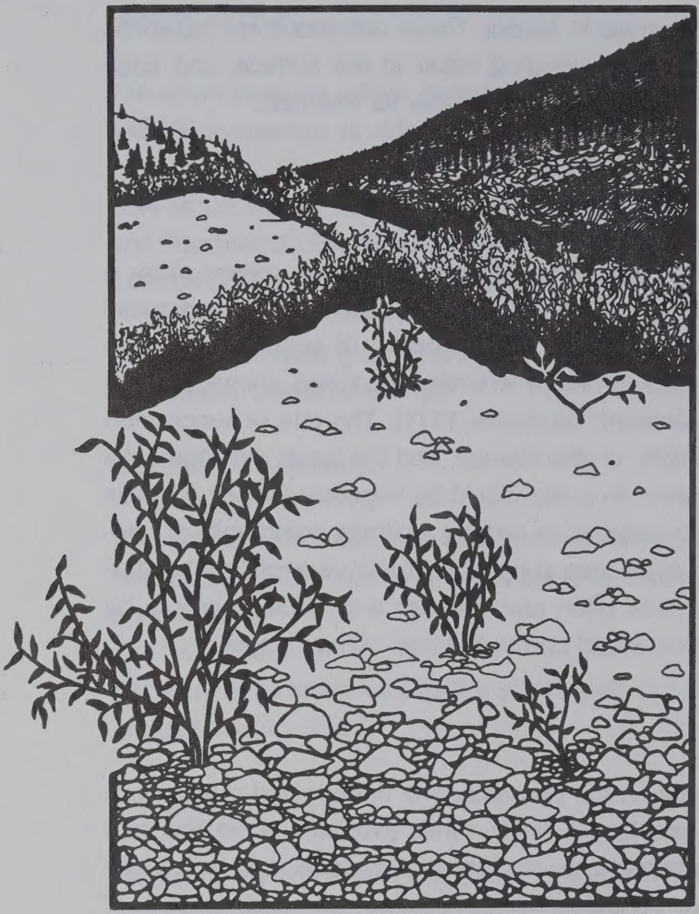
Succession in Mined Areas

Succession in placer mine tails depends very heavily on the percentage of fine-grained materials or "fines" in the substrate (Holmes 1981, Rutherford and Meyer 1981). Fines (particles of silt and clay size) directly control the water, oxygen, and nutrients available to plant root systems, and the quality of the initial seed or rooting bed. Other important considerations are micro-relief and sources of seed or vegetative propagules. Vegetation of mine tailings is considered an example of primary succession because the tailings are usually undifferentiated mineral materials with little or no organic content or seed bed.

Typically, mine tailings are initially invaded by annual grasses and forbs such as *Calmagrostis* and fireweed, with lupine and other legumes following. Scattered seedlings of willow and alder invade next, intermixed with birch or balsam poplar in some locations. Rose or bearberry may also occur, and initial bryophytes are usually *Sterocaulon* and hairy cap moss.

As the cover of shrubs expands, the ground cover increases and more species become established. Mosses such as *Hylocomium* and *Drepanocladus*, and lichens including *Peltigeria*, *Cladina* , and *Cladonias* comprise the ground cover. At this stage, ericaceous shrubs usually colonize, including blueberry, cranberry, Labrador tea, and mossberries. Spruce seedlings also begin to grow under the shrub cover during this period. The composition of the resultant community may be fairly stable for tens of years.

In cooler and wetter areas, the organic layer accumulates, *Sphagnum* mosses flourish, and permafrost redevelops. Eventually, a black spruce low shrub *Sphagnum* moss type covers the site.



Revegetation

In warmer, well-drained areas, a mature, single-aged birch and/or aspen stand usually develops, with alder, willow, and white spruce saplings in the understory. If left undisturbed for a long enough period, a mature white spruce forest with scattered birch, aspen, or balsam poplar develops on the site. Riparian communities often develop old stands of 200-300 year old white spruce and balsam poplar. Above the limits of tree growth, riparian zones usually consist of tall willow and alder.

The rate of succession seems to be heavily influenced by the proportions of particles of silt and clay size in the surface layer of the tailings. Rutherford and Meyer (1981), reporting on 30-40 year old communities on dredged tailings in the Tuluksak River, documented that the growth of sparsely vegetated shrubs through dense tall shrub stands depended on soil particle size. With an increase in fines from 10% to greater than 50% there was a corresponding increase in the amount of cover, vegetation height, and species diversity. Holmes (1981), working on 50 year old dredge tailings on Goldstream Creek at Fox, reports similar findings, with slightly longer time frames. This would be in keeping with the more northerly site. Halloran (1986), working on both recent and old tailings in the Birch Creek drainage, Circle mining district, found that vegetation development was enhanced in areas with greater fines content. This work included data on an undisturbed site with fines content of greater than 50%, while tailing samples ranged from less than 10% to approximately 50% fines.

Observations by BLM (Spencer 1987) during the summer of 1987 support these interpretations. Small willow seedlings from five to seven years old located on tailings with moderate fines content on Faith and Portage Creeks were seen, along with tall willows aged 17 years on tailings over 30 years old at the tailings/water interface on Deadwood Creek. Also noted were a tall alder/willow community on old, well-drained tailings aged approximately 40 years on Switch Creek, and dense grasses and willow shoots covering areas that had been stripped the previous year, but not sluiced.

Fire Succession

Past fire history and fire patterns have also influenced the distribution of landcover within the watershed. Fire changes the relationships between the plant and animal communities, as well as between the plants and the climate.

Often fire has positive benefits. For instance, ash from fires is high in calcium, potassium, phosphorous, and other minor elements that have been released from the organic matter in a usable, soluble form. Releasing these nutrients from the biomass is beneficial in the Alaskan environment because other processes of nutrient recycling such as weathering, decay, and oxidation are exceedingly slow in the arctic and subarctic biomes. The variations caused by fire burning patterns and the adaptations of different plant species to fire also creates a complex mosaic of plant communities and ecotones in various stages of succession. These plant communities provide habitats for a large variety of animal species. Fire creates more variations in both plant and animal communities than probably any other natural force. For example, in much of the forested areas, the variations of fire intensity and frequency determine whether the affected region will be occupied by moose or caribou. Fire-scarred landcover has a visual impact on the esthetic qualities of an area for recreation utilization for many years after a burn (Komarek 1971).

Often fire or fire suppression activities affect the thick vegetative mats that have a principal insulating effect on the soil thermal regime. When this mat is altered, the frozen subsoil, often rich in silt, is released when the permafrost melts. Surface slumping and sedimentation of streams are common results of this thermal disruption and can affect even flat terrain. The overall moisture relation and thermal effects from fire are more pronounced on the south-facing slopes where the moisture balance is more critical (Lotspeich and Mueller 1971).

Lotspeich and Mueller (1971) speculate that the vast majority of Interior Alaska has burned within the past 200-250 years, though this period could possibly be too long when compared to the normal species rotation ages. They estimate rotation ages of white spruce at 100-150 years, birch at 80-100 years, aspen at 60-80 years, and black spruce at 60-80 years.

Fire has less impact on white spruce stands which are found on valley floors and terraces of the riparian zone where the burning may be less severe. White spruce also lack ladder fuels, which reduces their susceptibility to crown fires. Black spruce, which frequently burns, is well adapted to fire because of serotinous cones which can release a viable seed crop shortly after a fire. However, repeated fires can convert spruce areas to birch and aspen stands which are then maintained as a disclimax. Deciduous broadleaf trees, due to the nature of their branching, are not so affected by crown fires. Aspen usually regenerates by vegetative reproduction from root suckers if the fire does not burn down to the mineral soil (Barney 1969).

3.5.4 Threatened & Endangered Plants

Within the Birch Creek drainage there are no formal "listed" or "candidate" threatened or endangered plant species. Candidate species are those plants included in the Federal Register "Notices of Review" listing that are being considered by the Fish and Wildlife Service (USFWS) for listing as threatened or endangered. Endemic species are those considered vulnerable because of a significant current or predicted reduction of populations, numbers, or habitat (Murray, Lipkin 1987). Birch Creek watershed contains only one of these species, *Poa Porsildii*, and these are endemic to the area where found. Beaver and Birch Creek drainages are the two known localities in which these plants exist in Alaska. They also occur in a few more areas in the Yukon Territory, with the main concentration being in southwestern Canada. They are usually found on or under persisting snow beds within dry alpine areas (Hulten 1968). The possibility of additional sensitive species existing within the watershed of Birch Creek is a distinct possibility because some localities are so remote that collections are sparse. Taxonomic studies are being conducted, but at this time they are incomplete.

3.6 Wildlife

3.6.1 Introduction

Terrestrial wildlife includes all animals that inhabit the upland and riparian portions of the physical environment. The mammal and bird species of most importance to humans for food, recreation, or economic purposes, and their associated habitats are emphasized in this analysis.

Wildlife habitat provides food, cover, water, and living space. Habitat is used by wildlife for all life-sustaining activities including breeding, foraging, drinking water, hiding and resting, and movement and protection. The number, types, and availability of wildlife habitats present and how they may be affected by mineral development in the area can be better understood by focusing on vegetation, a principle component of terrestrial habitat. The various successional communities of vegetation depend on the frequency and distribution of disturbances like fire and the substrate (soils) in the area. These vegetation patterns play an important role in influencing habitat diversity and, therefore, the number and type of habitats utilized by the various species.

3.6.2 Species and Habitats Present

Red Fox

The Birch Creek watershed is inhabited by many species typical to Interior Alaska. Caribou, moose, Dall sheep, grizzly bear, black bear, and wolf are the big game species most commonly present. Furbearers of economic importance in the area include marten, lynx, red fox, beaver, otter, and mink. Small game species include spruce, ruffed and sharp-tailed grouse, willow and rock ptarmigan, and snowshoe hare. The peregrine falcon, an endangered species, inhabits the area as do other raptors, including the bald eagle, golden eagle and red-tailed hawk. Waterfowl and many non-game mammal and bird species are also found throughout the area. Birch Creek flows north into the Yukon Flats where extensive lowlands and broad floodplains support large numbers of breeding ducks, geese, swans, and cranes. Additional information concerning species description and distribution is available in "Alaska's Wildlife and Habitat" (ADF&G 1978a), "Alaska Wildlife Management Plans - Interior Alaska" (ADF&G 1976), and "Alaska Habitat Management Guide for Mammals, Birds and Human Use" (ADF&G 1986b).

The area contains year-round habitat for the Fortymile caribou herd (Caribou Range Map). The Fortymile herd has increased in numbers from a mid-1970's low of about 5000 to the current estimate of approximately 16,500 (Valkenburg and Davis 1988b, pers. comm.). The current ADF&G population goal is 50,000. The upper Birch Creek watershed has historically been traversed by the Fortymile herd as it migrated to and from calving areas in the White Mountains. Calving has occurred in the upper Clums Fork and South Fork Birch Creek areas periodically from 1957-1976 (Davis et al 1976). During 1984 and 1985, calving in Birch Creek occurred in the South Fork Birch Creek, Puzzle Gulch, and Big Windy Creek headwaters. During the winter of 1981-82 about 20,000 caribou wintered within the range of the Fortymile herd in Birch Creek, Slate Creek, and the upper Salcha River. Heaviest use in Birch Creek occurred in Preacher Creek, Mastodon Dome, Porcupine Dome, along Birch Creek between Clums Fork and South Fork Birch Creek, and in all areas of higher elevation south of Birch Creek. Since 1982, some Fortymile herd caribou have wintered in the Birch Creek watershed, especially in the South Fork Birch Creek, Sheep Creek and Clums Fork areas (Valkenburg and Davis, 1988a; Durtsche and Hobgood, unpub. data). An increase in summer and fall use of the eastern White Mountains, Twelvemile/Eagle Summits, Porcupine Dome, and Mastodon Dome areas by caribou from the Fortymile herd has been documented since 1985 (Crain, unpub. data).

Moose populations in the upper Birch Creek watershed are low. Moose habitat in the area is dominated by spruce forest, with stands of willow along rivers and streams which provide important late winter browse (Moose Range Map). Early successional stages of vegetation following fires are commonly utilized by moose in early winter, but are only a small portion of the moose habitat in the area. The quantity and quality of moose browse has been reduced by past wildfire suppression activities and habitat loss from placer mining in Harrison, Crooked, Porcupine, Mastodon, Deadwood, Ketchum, and Portage Creeks, and other streams in the Birch Creek headwaters in the vicinity of the Steese Highway southwest of Eagle Summit.

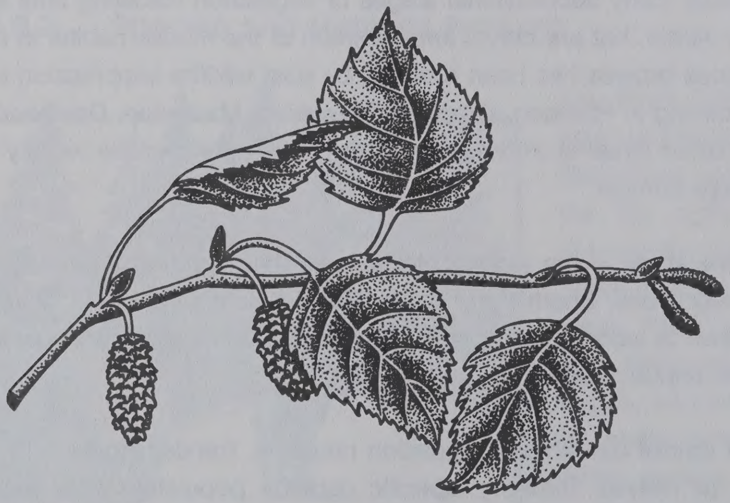
Dall sheep historically occupied alpine areas in the vicinity of the watershed divides of the Middle Fork, Chena River, Clums Fork, Sheep Creek, South Fork, Birch Creek, Salcha River, and Charley River. At present, Dall sheep are known to occupy areas in the Big Windy Creek and Puzzle Gulch areas of upper Birch Creek (Durtsche, unpub. data).

No data are available for location of crucial use areas, population numbers, trends, productivity or survival of grizzly bear, black bear or wolves. Similarly, specific data on population size, trend, productivity, and use areas for raptors (Wildlife Raptors Map), furbearers, small game, and non-game species is also lacking.

3.6.3 Present Situation in Relation to Mineral Development

Construction of 110.8 total miles of permanent gravel roads, excluding the Steese Highway and Circle Hot Springs Road, has resulted in the loss of 672 acres of wildlife habitat in the Birch Creek watershed. Permanent gravel roads directly associated with federal mineral development total 58.2 miles (353 acres), those directly associated with State and private mineral development total 15.5 miles (94 acres), and those associated with federal, State, and private mineral developments total 37.1 miles (225 acres). The establishment and use of 65.9 miles of primitive roads and trails has resulted in 42,678 acres of wildlife habitat subject to short-term periodic disturbance by vehicular traffic when wildlife such as moose, caribou, and others are present. The existing primitive roads and trails in Birch Creek are used to access federal mineral developments only. The present level of vehicular use on roads and trails (excluding the Steese Highway and Circle Hot Springs Road) is periodic and has not resulted in alteration of wildlife movement routes, disturbance, or disruption of seasonal use areas. Improvement of existing trails and roads into Fryingpan Creek, Great Unknown Creek, Clums Fork, Sheep Creek, portions of Harrison Creek, and other areas of upper Birch Creek has indirectly resulted in increased harvest of moose, caribou, grizzly bear, black bear, furbearers, and other species. Improving or establishing new access in remote areas has indirectly facilitated more wildlife habitat loss and disturbance in wildlife use areas over the long-term by enhancing the feasibility of mining more and larger areas.

Facilities associated with working mining camps in Birch Creek have resulted in the long-term loss of 65 acres of winter range for moose in Crooked and Harrison Creeks, and their tributaries, the Birch Creek headwaters, and other areas. Facilities directly associated with federal mineral development total 39 acres and those associated with State and private mineral development total 26 acres. Similarly, 1,170 total acres of riparian habitat used by moose and other species are unavailable for the short term due to frequent human disturbance during May through October at mineral development sites. Federal sites accounted for 702 acres; while State and private activities comprise 468 acres of the total area subject to disturbance. Grizzly or black bears have been removed as nuisance animals because of being attracted to refuse or solid waste in the vicinity of mining facilities.


Birch Branch

Activities associated with mining operations have resulted in long-term adverse effects to approximately 3,669 total acres of moose winter range in Crooked and Harrison Creeks, and their tributaries, the Birch Creek headwaters, and other areas. The habitat lost to mining operations associated with federal mineral development in 1987 is 220 acres and habitat losses associated with State and private operations total 370 acres. Reclamation of federal mining areas disturbed since

Birch Creek **Placer Mining**

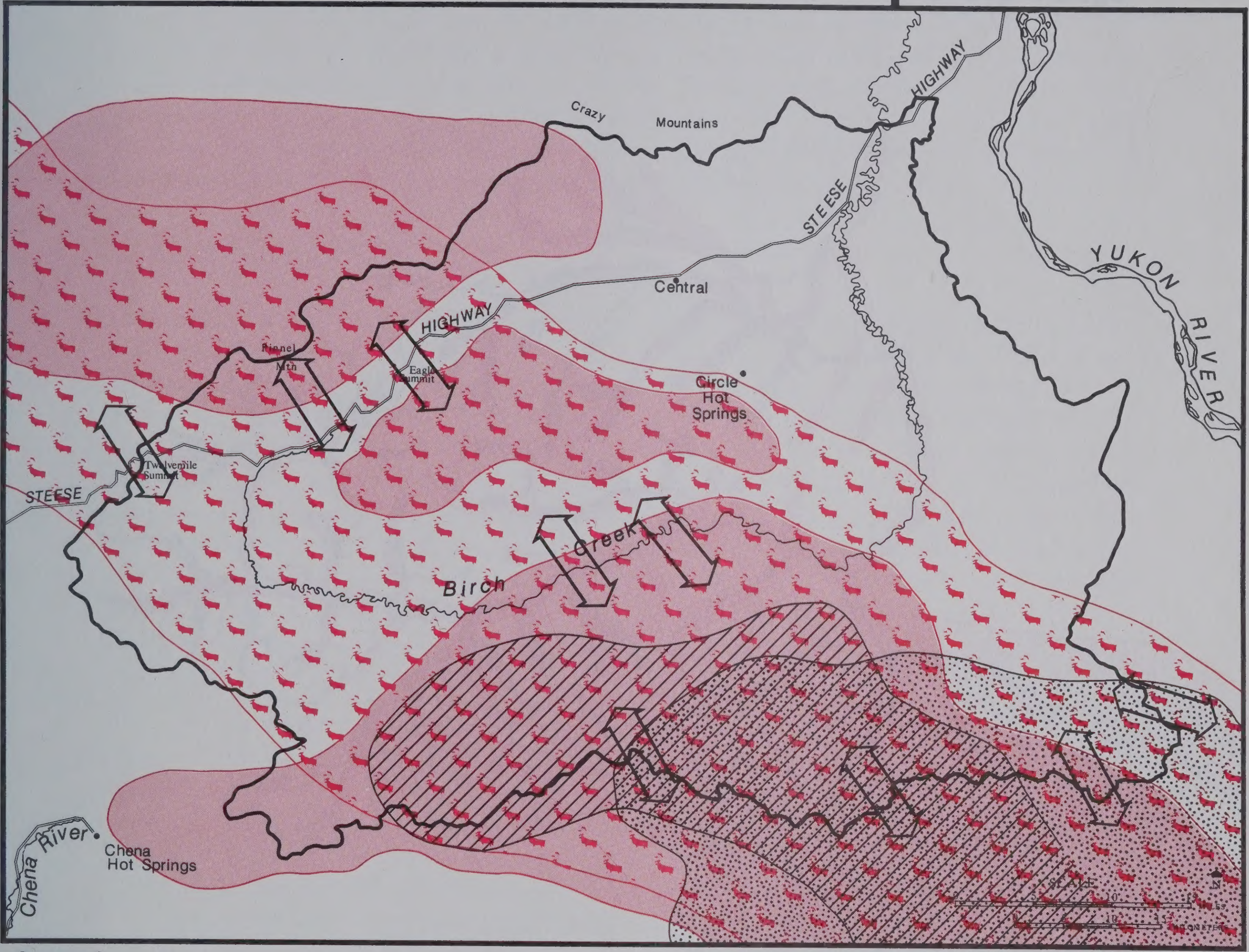
DRAFT

Cumulative Environmental Impact Statement

Wildlife 1 of 2

Caribou Range

Fortymile Caribou Herd


Crazy
Mountains
HIGHWAY
STEESE
Central
YUKON
RIVER
HIGHWAY
Pinnel Mtn
Eagle Summit
Circle Hot Springs
Twelvemile Summit
STEESE
Creek
Birch
Chena River
Chena Hot Springs
SCALE
0 5 10 15
MILES
0 5 10 15
KILOMETERS
N

Legend

⟺ Principle movement routes

🦌 Summer distribution (recent)

🟪 Winter use areas since 1981

▨ Historic calving area 1957-76

░ Recent calving area 1984-85

LOCATION MAP

FAIRBANKS
Birch Creek Watershed
ANCHORAGE

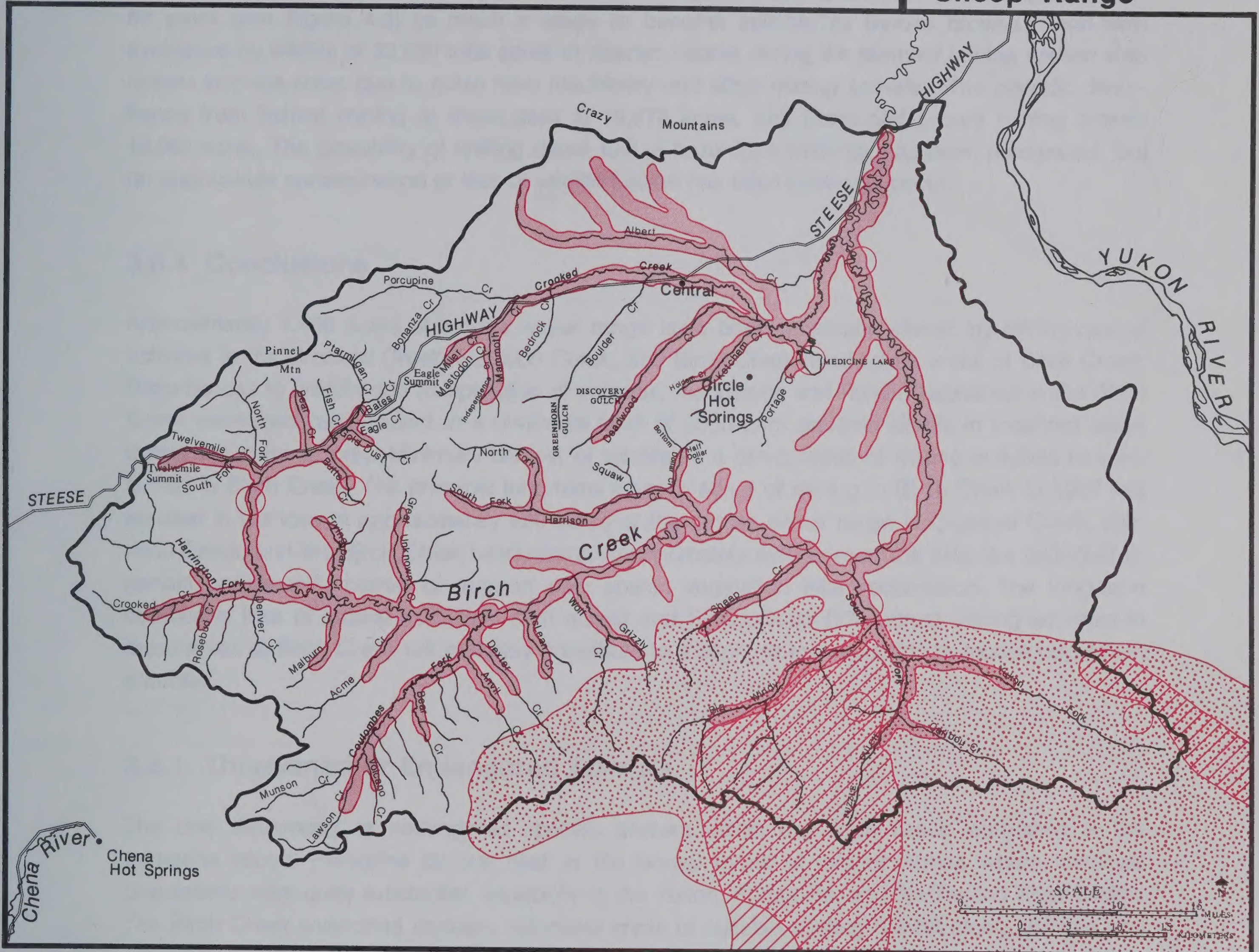
Birch Creek Placer Mining

DRAFT

Cumulative Environmental Impact Statement

Wildlife 2 of 2

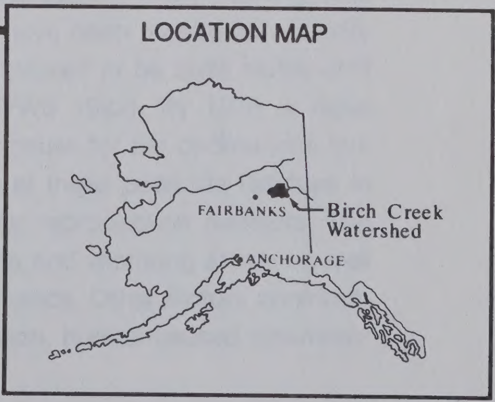
Raptors, Moose Range and Dall Sheep Range



Crazy
Mountains
HIGHWAY
STEESE
YUKON RIVER
Albert
Crooked
Creek
Central
Porcupine
Cr
Bonanza Cr
HIGHWAY
Pinnel Mtn
Ptarmigan Cr
Eagle Summit
Miller
Mastodon Cr
Mammoth
Independence Cr
Bedrock Cr
Boulder Cr
DISCOVERY GULCH
GREENHORN GULCH
Deadwood
Holdem Cr
Ketchem Cr
Circle Hot Springs
Portage Cr
MEDICINE LAKE
Bottom
Bottom Dollar
Half Dollar Cr
Squaw
North Fork
Cr
Harrison
South Fork
Birch
Creek
Bates
Fish Cr
Bear Cr
Eagle Cr
Gold Dust
Cr
North Fork
Twelvemile
Twelvemile Summit
South Fork
Butte Cr
STEESE
Harrington Fork
Crooked Cr
Rosebud Cr
Denver
Cr
Malburn
Ptarmigan
Great Unknown
Acme
Cr
Fork
Bear
Cr
Anvil
Dexter
McLean
Wolf
Grizzly Cr
Sheep
Cr
Cr
Clums Fork
Cr
Volcano
Cr
Munson
Cr
Lawson
Cr
Windy
Fork
Faith
South
Fork
Caribou Cr
Fork
Chena River
Chena Hot Springs
SCALE
0 5 10 15 MILES
0 5 10 15 KILOMETERS
N

Legend

- ▨ Winter high use areas for moose
- ○ Known raptor nesting habitat
- ░ Historic distribution of Dall sheep
- ▧ Present distribution of Dall sheep



LOCATION MAP
FAIRBANKS
Birch Creek Watershed
ANCHORAGE

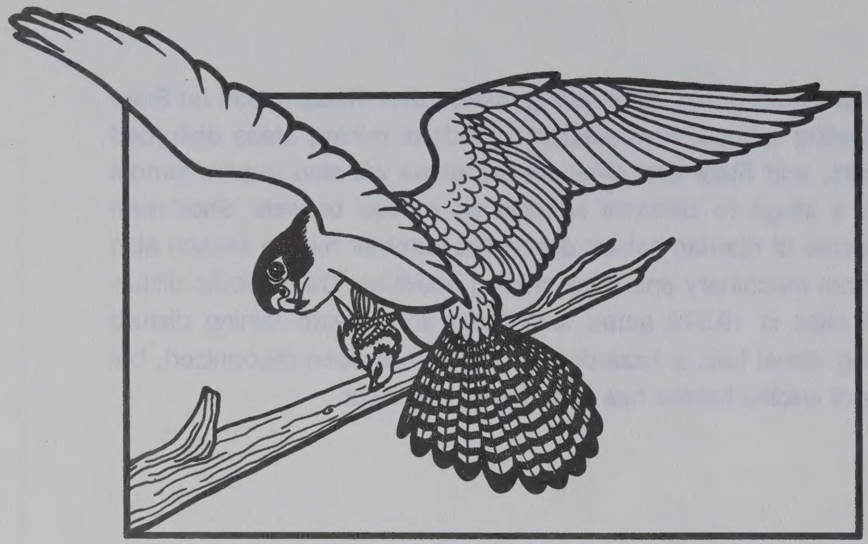
1981 consists of leveling tailings and stockpiling and respreading overburden. Reclamation on State and other areas would consist of leveling tailings. Revegetation in federal mining areas disturbed since 1981 will require almost 50 years, and State and other mining areas will also require almost 50 years (see Figure 4-3) to reach a stage to become suitable as moose browse. Short-term avoidance by wildlife of 32,630 total acres of riparian habitat during the summer mining season also occurs in these areas due to noise from machinery and other mining activities. The periodic disturbance from federal mining at these sites is 19,578 acres, and State and private mining disturb 13,052 acres. The possibility of spilling diesel fuel, a hazardous material, has been recognized, but no appreciable contamination or loss of wildlife habitat has been known to occur.

3.6.4 Conclusions

Approximately 4,406 acres of moose winter range have been physically altered by mining-related activities in the Crooked Creek, Harrison Creek, and Birch Creek headwaters areas of Birch Creek. Disturbances to wildlife due to operation of vehicles, machinery, and human habitation in the Birch Creek watershed has resulted in a minimum level of short-term adverse effects in localized areas during the summer only. Minimum harvest of wildlife as a direct result of mining activities has occurred in Birch Creek. The principal long-term adverse effect of mining in Birch Creek in 1987 has resulted in the loss of approximately 590 acres of the moose winter range in Crooked Creek, Harrison Creek, and the Birch Creek headwaters. Approximately 470 acres of the area are expected to remain permanently barren or support only sparse vegetation after reclamation. The long-term cumulative loss of habitat to federal (220 acres) and State/private (370 acres) mining activities in these areas of Birch Creek will probably contribute to a slight to low reduction in moose population potential.

3.6.1 Threatened or Endangered Animals

The only threatened or endangered species present within the Birch Creek watershed is the peregrine falcon. Peregrine falcons nest in the boreal forest of Interior Alaska where historical populations were quite substantial, especially in the Yukon, Porcupine, and the Tanana River basins. The Birch Creek watershed contains extensive areas of suitable nesting habitat along streams and upland areas, with five to eight breeding pairs present annually (Wildlife raptors map). Nesting sites have been identified within the Birch Creek Wild River Corridor and have been monitored annually (Durtsche, pers. comm.). The regional population of the peregrine appeared to be quite stable until the mid 1960's, except for local minor reductions in numbers (USFWS 1982). By 1970, a rapid decline in the population was evident. Data suggest that the principle cause for the decline was due to chlorinated hydrocarbons (DDT metabolites). High concentrations of these pesticide residues in breeding peregrines resulted in eggshell thinning and ultimately lower reproduction numbers. The birds obtained the pesticide from contaminated prey on their breeding and wintering areas, as well as en route to and from their wintering areas in Central and South America. Other factors contributing to the overall reduction in breeding populations were egg collection, human-caused disturbances, and habitat destruction.



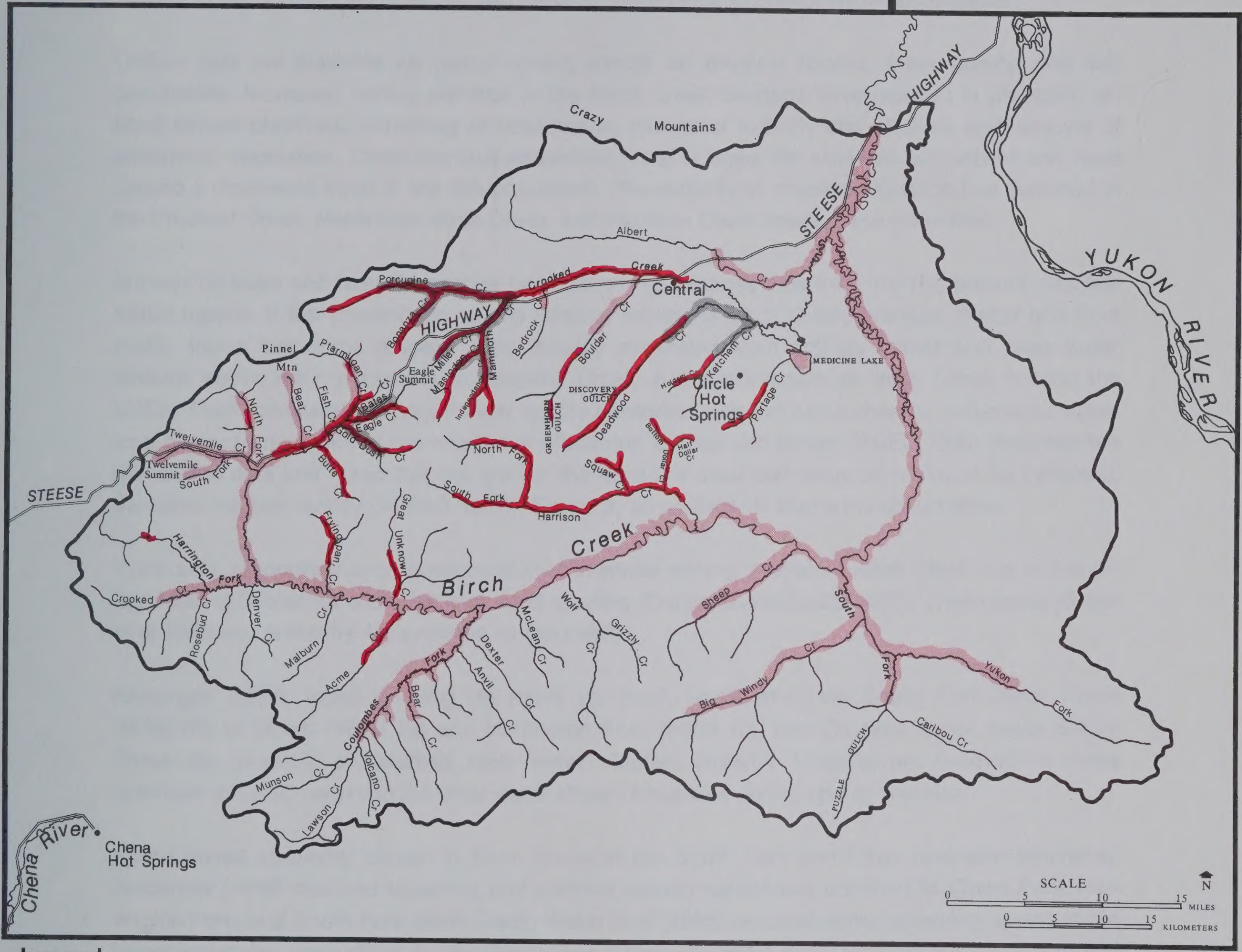
Peregrine Falcon

Because of strict pesticide control and protective management nationwide, the overall population of the peregrine falcon has been steadily increasing over the last few years. Numbers of breeding pairs in the main nesting areas in Interior Alaska have come close to historic levels, and it appears the population is approaching levels to allow dispersal into other drainages where reoccupation of historic nest sites and other nesting habitat is occurring (Ambrose, pers. comm.). Maintenance and protection of breeding habitat is a basic step towards establishment of a self- sustaining population (USFWS 1982).

3.7 Fisheries

Birch Creek is a moderately swift, shallow stream surrounded in the upper reaches by rolling hills and low mountains. The lower reaches of the stream are slow and shallow, surrounded by flat land and some hills. Topographic relief and water current diminish as Birch Creek flows through the Yukon Flats to its confluence with the Yukon River, a total distance of 344 miles. Birch Creek was designated by Congress (ANILCA) as a National Wild River on December 2, 1980. Approximately 77 miles of the 126 mile long Birch Creek National Wild River (NWR) flows through the Steese National Conservation Area (SNCA).

Anadromous and resident fish species that may occur within the Birch Creek drainage in the SNCA and the NWR include arctic grayling, broad whitefish, humpback whitefish, round whitefish, burbot, northern pike, slimy sculpin, longnose sucker, sheefish, chinook salmon, coho salmon, and chum salmon. Arctic grayling is the most widespread resident species in the drainage. Salmon have been present, but were last documented in Birch Creek in 1971 near the Steese Highway Bridge. A survey of Birch Creek was conducted by the ADF&G Commercial Fish Division in August, 1971. They reported chinook salmon in spawning condition just above the bridge at Milepost 147 of the Steese Highway (Barton 1984). Salmon have not been documented beyond the bridge since that time. Species description and distribution maps, except for slimy sculpin and longnose sucker, can be found in "Alaska Fisheries Atlas" (ADF&G 1978b). Basic data collected on Birch Creek resident fish addresses summer distribution and aspects of life history. Limited work has been done on overwintering aspects of fish biology in the Birch Creek drainage. Available fish habitat includes South Fork, Clums, and Harrington Forks, and other undisturbed streams of upper Birch Creek. Fish species have been reported to utilize these habitats for spawning, rearing, feeding, and migration

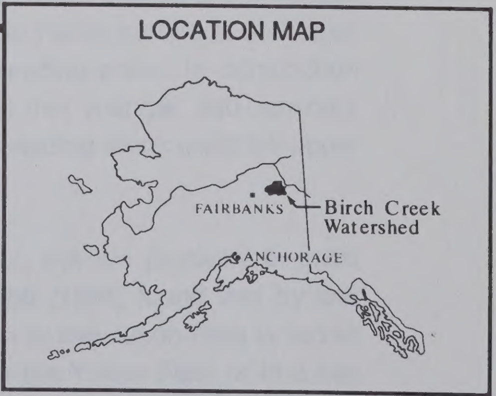

Crazy
Mountains
HIGHWAY
STEESE
YUKON RIVER
Albert
Crooked Creek
Central
Porcupine Cr
Bonanza Cr
HIGHWAY
Miller Cr
Mastodon Cr
Independence Cr
Mammoth Cr
Bedrock Cr
Boulder Cr
Deadwood
Ketchem Cr
MEDICINE LAKE
Circle Hot Springs
Portage Cr
Holden Cr
DISCOVERY GULCH
GREENHORN GULCH
Pinnel Mtn
Ptarmigan Cr
Eagle Summit
Bear Cr
Fish Cr
North Fork
Bates
Eagle Cr
Gold Dust
Twelvemile Cr
Twelvemile Summit
South Fork
Butte Cr
North Fork
South Fork
Harrison
Bottom Dollar Cr
Half Dollar Cr
Squaw Cr
STEESE
Harrington Fork
Frying Pan Cr
Great Unknown Cr
Birch Creek
Crooked Cr
Rosebud Cr
Denver Cr
Malburn Cr
Acme
Cr
Wolf Cr
McLean Cr
Grizzly Cr
Sheep Cr
South Fork
Dexter
Anvil Cr
Fork
Bear Cr
Coutombes
Volcano Cr
Munson Cr
Lawson Cr
Big Windy Cr
Yukon Fork
Caribou Cr
GULCH
PUZZLE
Chena River
Chena Hot Springs
SCALE
0 5 10 15 MILES
0 5 10 15 KILOMETERS
N

Legend

▨ Stream reaches where fish were reported prior to 1977 only.

🟪 Stream reaches where fish have been collected between 1984-1987.

🟥 Stream reaches disturbed by placer mining.


LOCATION MAP
FAIRBANKS
Birch Creek Watershed
ANCHORAGE

routes. A critical element for fish survival is overwintering areas, which may be in short supply. Overall water quality in these undisturbed upper Birch Creek tributaries is good. Aquatic invertebrates are present in the undisturbed streams, with reduced abundance in previously mined streams.

Limited data are available on placer mining effects on physical habitat, water quality, and fish populations. Increased mining activities in the Birch Creek drainage have resulted in physically altered stream channels, cementing of streambeds, increased turbidity and siltation, and removal of streamside vegetation. These physical alterations have reduced the available fish habitat and have caused a downward trend in the fish population. The majority of physical alteration has occurred in the Crooked Creek, North Fork Birch Creek, and Harrison Creek areas of the watershed.

Surveys by State and federal agencies have compared fisheries data from 1977 to present with historical reports of fish presence in several streams within the Birch Creek drainage. Weber and Post (1985) found that arctic grayling were virtually eliminated from actively mined and clear water streams above mining activities in Crooked Creek, a major tributary of Birch Creek outside the SNCA. They speculated that poor water quality combined with extensive channel disturbance acted as a barrier to migration to the headwater tributaries. Dames and Moore (ADEC 1986) analyzed fish distribution data and noted that the greater the length of disturbed channel that must be traversed, the lower the fish density (ADF&G 1987b, Figure 2, fish collected) above the disturbance.

In the past, particularly prior to resumption of intensive mining, mainstem Birch Creek was an important feeding habitat for sub-adult and adult grayling (Durtsche and Webb 1977). These areas (Webb et al 1985) are presently not available as fish habitat.

Kretsinger (1986) found grayling do move up Birch Creek from the South Fork Birch Creek (WRM 68) to Clums (WRM 34) and Harrington Fork (WRM 10), and Crooked Creek inside SNCA. These are generally undisturbed clear water tributary streams. Grayling are believed to move upstream in turbid waters to the clear water stream tributaries during spring breakup.

Some limited spawning occurs in Birch Creek in the South Fork and other upstream tributaries. Kretsinger (1986) reported spawning and summer rearing habitat was confined to Clums Fork, Harrington Fork, and South Fork Birch Creek. Webb et al (1985) reported some spawning occurs in the upper tributaries exemplified by the Twelvemile Creek spawning area. Both Kretsinger (1986) and Webb et al (1985) reported that areas such as South Fork, Clums Fork, Harrington Fork, and other undisturbed tributaries may serve primarily as summer rearing and feeding areas. In conjunction with the importance of upper stream areas, Hughes et al (1987) found that younger, sub-dominant fish used the large pools of the downstream reaches while the larger breeding stock used the upper reaches of these creeks for summer rearing.

Overwintering areas may exist throughout the Birch Creek watershed, but are probably in short supply, especially in the extreme upper Birch Creek. Vogler and Webb (1984) found that by late winter most of mainstem Birch Creek from the North Fork downstream to the Yukon Flats is frozen solid. They found the only potential area for overwintering fish was in the Yukon Flats or in a few isolated areas of groundwater upwelling as indicated by a few scattered aufeis fields in upstream areas. They presumed that open water leads noted in the Flats are a result of groundwater seepage which increases significantly as the stream approaches the Crazy Mountains in the vicinity of Crooked Creek. This area is outside the SNCA. Fish overwintering areas were not located, but were thought to exist farther downstream where flow conditions could be more favorable.

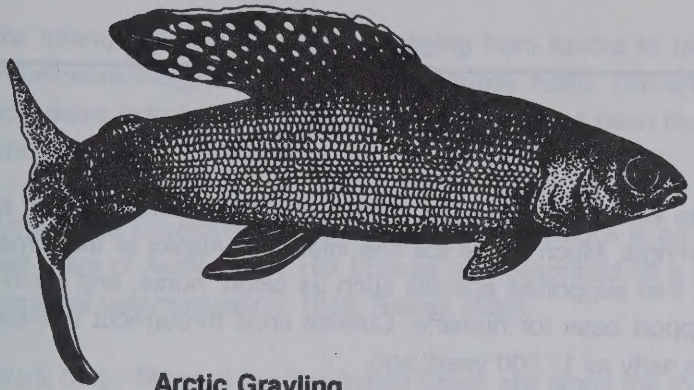
Preacher Creek is a major tributary to Birch Creek, with the confluence downstream and outside of the study area. The Preacher Creek watershed lies within the SNCA and Yukon Flats National Wildlife Refuge. This stream is a generally pristine system that provides spawning, overwintering, and rearing habitat for grayling (Webb et al 1985). Disturbance in Preacher Creek has occurred in Bachelor and Loper Creeks and is a result of placer mining activities.

Data on aquatic invertebrates was gathered by Weber and Post (1985) for the unmined Crooked Creek watershed which lies outside the SNCA. Weber and Post (1985) collected aquatic beetles, crane and blackflies, mayflies, amphipods, aquatic earthworms, stoneflies, and caddisflies. Weber and Post (1985) found that mayfly and stonefly occurred rarely in areas downstream from mining if at all (an average of fewer than 0.5 invertebrates per sample was found). It was noted that invertebrate population numbers in previously mined sites were lower than population numbers in unmined sites. The aquatic insects appeared to successfully recolonize disturbed areas that have been restored. It is believed that this is due to aerial dispersion and propagation.

Water quality data for Birch Creek and its tributaries have been recorded by both federal and State agencies since 1969 (DOI 1969). Most of these data were gathered to study the effects of placer mining on water quality of streams. The primary water quality elements determined were turbidity, settleable solids, suspended sediment and total metals (DOI 1969). The water quality of unmined streams is better than that of mined streams. Water quality data gathered for Crooked Creek by Weber and Post (1985) document that increased discharge from placer mining not only affects the disturbance zone itself or the immediate downstream area of active mining, but persists far downstream; therefore creating adverse impacts to Birch Creek and the downstream fishery resources.

Because of low ground water recharge, streams above the South Fork confluence depend on spring runoff and summer rains to sustain flows required for fish species' life cycles. Summer water levels are critical because high flows are needed to flush streambeds of sands and silts from unmined and especially mined streams. Dames and Moore (ADEC 1986) determined that a bankfull, or two year flood, would probably flush most of the fine sand and silt deposited on the substrate surface, but would not remove fine particles that were trapped within the streambed gravels and cobbles.

Arctic grayling is the most numerous sport fish in nearly all streams and may be the only one found in many tributaries of Birch Creek. This species is of prime importance to recreational users of Birch Creek National Wild River. Data on use of fish by sport anglers is generally not available for the Birch Creek and Crooked Creek drainages (ADF&G 1987b). Dames & Moore (ADEC 1986) reported that increased mining activities in the Birch Creek drainage, especially since late 1970's, has reduced the use of the river by some recreational users. They further state, "several recreational users correlated an increase in mining activity with a decrease in the quality of grayling fishing in Birch Creek."



Arctic Grayling

Durtsche and Webb (1977) recorded sport fishing efforts during July 1977 of 30.5 hours by 32 anglers to catch 149 grayling, a catch of 4.9 fish per hour. The sport fish census was taken between the confluence of the North Fork of Birch Creek and the Steese Highway Bridge when mainstem Birch Creek was relatively undisturbed for grayling and other species.

The benefits of other species of fish from Birch Creek to commercial and subsistence users is not known. Historically, fish have been reported by local residents and placer miners to occur in Birch Creek (ADF&G 1987b). Residents reportedly netted whitefish just below the Crooked Creek bridge in Central during the fall (ADF&G 1987b). Economic values are unknown.

Stream segments disturbed by mining (ADF&G 1987b, Figure 3) are characterized by increased non-point source sediment pollution; loss of riparian vegetation and associated soils; elimination of stream banks when overburden is removed; diversion of stream channels followed by loss of pools, meanders, and other habitat features; change in substrate conditions and adverse changes in water quality. Dames and Moore (ADEC 1986) identified additional physical changes, including elimination of the thalweg and widening of the stream channel.

Dames and Moore et al (ADEC 1986) demonstrated from the data in the Birch Creek Basin that each mining operation added, on average almost 2,100 mg/l of total suspended sediment. Clearly, on Birch Creek, a stream with multiple federal and State and private mining sites, this constitutes a cumulative impact to the aquatic ecosystem. The same is true regarding the physical disturbance caused by activity on multiple mine sites in the upper portions of the basins. Physical disturbance had altered 22.9 km of the 60.2 km (37.55%) of streams in their study area. If the areas blocked from access to fish because of this physical disturbance were added to these figures the total area affected would increase substantially. As a result, channel disturbance has resulted in direct cumulative effects through reduction in physical habitat area within the upper basin as well as indirect cumulative effects through exclusion of fish access to clearwater tributaries upstream of the mining activity.

3.8 Cultural Resources

3.8.1 Prehistory

It is now well accepted that, during the late Wisconsin glaciation, Alaska and Siberia were part of a single continental land mass known as Beringia. Much of the ice-free interior of Alaska at that time consisted of a steppe-tundra environment that supported animals such as bison, horse, and mammoth. This rich fauna also provided a support base for humans. Cultural finds throughout Interior Alaska indicate the presence of humans as early as 11,000 years ago.

Work by West in Interior Alaska has resulted in the definition of an important artifact assemblage known as the Denali complex. This complex is between 8,000 and 11,000 years old and contains such characteristic elements as distinctive wedge-shaped microblade cores, burins made on flakes (Donnelly burins), biconvex bifacial knives, blades, and tchi-thos (West 1981). Components of this complex are geographically widespread in Alaska. A microblade core discovered during a 1983 BLM cultural resources survey on Birch Creek (Will 1986) resembles the Denali microblade cores in style. Another site along Birch Creek yielded two possible microblade fragments.

One of the earliest firmly dated interior Alaska sites, Dry Creek, dates to approximately 11,000 B.P. (Thorson and Hamilton 1977). Component I of this site, located along the northern flanks of the Alaska Range, contains cultural material similar to that found in the lowest levels of a site at Healy Lake. This material, known as the Chindadn complex, differs from the Denali complex in that a different form of bifacial projectile or knife is present. Chindadn points date between 9,000 and 11,000 years old (Cook 1975). A basally-thinned projectile point base discovered during the 1983 BLM survey near a tributary of Birch Creek also resembles Chindadn material (John Cook, personal communication, 1983).

An archaeological site was discovered by West in 1965 on a gravel bar along Birch Creek opposite a high bluff. West felt that the bluff was probably Wisconsin in age, but that the lower sections may have represented an earlier Pleistocene stage (West et al 1965). The artifacts were described as "pebble tools" - chert river cobbles which had flakes removed. Both a mammoth and a horse tooth were found on the same gravel bar. Additional pebble tools were found nearby.

Although the cultural affinity of these artifacts and their faunal associations have not been confirmed, artifacts in central Alaska which date as early as 11,000 B.P. have been found in association with Pleistocene megafauna at such sites as Dry Creek. The potential for an archaeological discovery for these types of paleontological remains along Birch Creek cannot be ignored. Bluffs, fluvial benches, and the possible older lacustrine benches may yet yield such material.

West discovered the Twelve Mile Bluff site downstream from Circle on the Yukon River. This site is significant because it is the only excavated one in the vicinity which represents the Northern Archaic Tradition. The diagnostic artifact from this site is a side-notched projectile point. Endscrapers, knives, tchi-thos, side scrapers, and notched pebble axes were also discovered (West et al 1965). The Northern Archaic began approximately 6,000- 6,500 years ago. At this time, the environment of the Interior was warming and changing from tundra to taiga with the coincident disappearance of Pleistocene megafauna (Bacon and Holmes 1980). The appearance of the Tuktu phase of this tradition dates only to about 5,000 years ago and has been found at sites throughout Alaska (West et al 1965).

Among the University of Alaska Museum accessions is an isolated find discovered within one and a half miles of Arctic Circle Hot Springs and described as a side-notched projectile point (John Cook, personal communication, 1983; Rainey 1939).

Work by Le Blanc at the Rat Indian Creek site along the Porcupine River in the Yukon Territory indicates that the site can be integrated into the existing prehistoric framework for the northern Yukon and other areas of the western subarctic (Le Blanc 1984). He proposed two phases which accommodate the components at Rat Indian Creek as well as other middle Porcupine sites. The earlier, the Old Chief Phase, extends from 900 B.C. to A.D. 700 while the later, the Klo-kut Phase, begins about A.D. 700 and continues through the arrival of European traders. The latter includes the level five component at Rat Indian Creek and the prehistoric levels from the Klo-kut site. The Klo-kut site, a stratified Athabaskan site in the Yukon Territory, was occupied throughout the last 1,000 to 1,500 years (Morlan 1973).

Le Blanc's conclusion about these site comparisons describes a relationship referred to as the "Athabaskan Tradition," that has components found in several sites throughout Alaska and Canada. Collectively, these late prehistoric manifestations can be considered as a broadly defined technocomplex spanning the period from roughly A.D. 700 to the mid-nineteenth century (Le Blanc 1984).

Although no sites are known from the Birch Creek drainage that can be dated to this time, Crooked John's Village (West et al 1965), which was possibly located near the mouth of Crooked Creek, may have represented this period.

To summarize, there are no sites within or near the Birch Creek drainage which in 1988 are on or eligible for inclusion in the National Register of Historic Places. Also, there are no World Heritage sites in this vicinity, with the nearest one being Wrangell-St. Elias Park, about 200 miles to the south.

3.8.2 Ethnographic History

Ethnographic literature for the Birch Creek area is limited. According to Orth (1971), the upper mouth of Birch Creek bore the Indian name "Nocotocargut," as reported by the Western Union Telegraph expedition. This river was also called the "She Beaver" (Baker 1901). Frederick Whymper, a member of the expedition, visited Fort Yukon in 1868 and noted that "some of the Gens de bouleau, or Birch River Indians, ...were present...." (Whymper 1868).

Osgood's monograph (1936), based on fieldwork undertaken during the summer of 1932, refers to the "Birch Creek" or "Tennuth" Kutchin in only two paragraphs, but does provide a territorial map showing the distribution of the Kutchin groups. The monograph contains the following information:

> "No complete study of the Kutchin nation can ever be made. Within 25 years of their first discovery, the Birch Creek Kutchin were annihilated by an epidemic of scarlet fever. Both Birch Creek and Black River are roughly parallel to the Yukon but are mountain tributaries. The culture of these areas is that of people who live along small streams, turning periodically to the comfortable protection of their small isolated valleys [Osgood 1936]."

Most of Osgood's data came from informants at Circle and Fort Yukon (Osgood 1936).

The correlation between the Black River and Birch Creek is also mentioned in information provided by Birch Creek Jimmy, a resident of the small village at the mouth of Birch Creek (Schneider 1974, 1976).

Birch Creek Jimmy was born in 1884 at Chalkytsik and spent his early years on the Black and Porcupine Rivers. He remembered life as being extremely hard there; his family lived in a skin tent which they shared with another family. They had few trade goods, only muzzle loaders, and used bows and snares to hunt rabbits. People lived off moose, caribou, fish, and according to Jimmy, ducks "which couldn't fly in the summer" (Schneider 1974).

By 1900, Jimmy was living at Birch Creek with his family and brother-in-law who was the grandson of the famous Kutchin chief, Sahnyaati'. They built their camp at the mouth of the Creek where two Hudson's Bay men, Anderson and Less, had formerly lived and operated a fish camp.

Whether these are the "Birch Creek Kutchin" to whom Osgood refers is unknown. According to Birch Creek Jimmy's description, their seasonal cycle was based in the lower reaches of Birch and Beaver Creeks where the country was quite different from the Black and Porcupine River country - "...kind of easy - a little bit fish, ducks, fur" (Schneider 1974). Once they had moved from the Black and Porcupine country to the mouth of Birch Creek it appears that they didn't move far from the Flats, relying on that country to provide them with game and furs which they traded at Fort Yukon. Fish were obtained in the creeks by using nets and traps.

The current Birch Creek village residents consider themselves "Dendu Gwich'in," who traditionally occupied the Yukon Flats region south of the Yukon and portions of the Crazy and White Mountains (Caulfield et al 1983).

According to David James, Birch Creek Jimmy's son, his father recounted that the original "Dendu Gwich'in" were "mountain people" who lived principally in the foothills of the White Mountains and utilized primarily caribou and sheep. The "Gwit'ee Gwich'in" were said to be the band who lived along Birch Creek and their name meant "people living under," perhaps referring to the fact that the band lived at the base of the White Mountains. The name "Dendu Gwich'in" means "people of the other side," which is apparently a name assigned to the band by another group and not traditionally used by the band to describe itself (Caulfield 1983). However, Jimmy says that Sahnyaati' and his family moved around the country, living at Birch Creek, Fort Yukon, and Circle - "Circle country like their country" (Schneider 1976). Raymond had encountered them in Rampart Canyon in 1869 at a fish camp which was about 160 miles down the Yukon.

It appears that boundaries and groups were hardly formal, at least by that time, and were based primarily on the availability of resources. Sahnyaati', who died in 1894, had ten wives" ...one from Arctic Village, and one from Old Crow" (Schneider 1976). According to Jimmy, they didn't all live together although Sahnyäati' did have a village above Circle. This may have been 26 Mile Village, reported by West in 1965, and which Andrews (1977) suspects was located opposite 26 Mile Creek along the Yukon River. As she points out, the site was linked to Medicine Lake by a trail:

> "This lake and the immediate vicinity were probably very significant to the native history and culture of the area in earlier times. Since several native settlements on the Yukon River... connect to this lake by trail the area obviously played a significant role in the annual cycle of the people. The geographical setting indicates that the area was conducive to native habitation. The area seems to warrant an archaeological survey. (Andrews 1977)"

An historic map by Bruce (1899) shows a native village along Birch Creek. During West's 1963 survey along Birch Creek, he mentions looking for the site of "Crooked John's village which was probably a short distance down Crooked Creek from the mouth of Jumpoff. It was not located" (West et al 1965).

Neither could this site be located during the 1983 survey, but a conversation with Marsha Behr, who lives at Jumpoff Creek, revealed that a site had existed just downstream from Crooked Creek along Birch Creek (Marsha Behr, personal communication, 1983). This site may have been Crooked John's Village, as well as where West reported finding a piece of chert and some bone fragments (West et al 1965). Behr thought that the site had been quite large at one time, but it has now entirely eroded into the river.

Other cultural material discovered during the 1983 BLM survey, at sites overlooking the river, consisted of lithic flake scatters that cannot be assigned to a particular cultural tradition.

West conducted a brief survey of Medicine Lake and encountered a cabin on the peninsula jutting into the lake which was used seasonally by a local Indian family. Additional cabin sites and the Old Village site, located in the Yukon Flats near the mouths of Birch Creek, were examined in 1983 (Slaughter n.d.). Most of these were trapping cabins used by Native Kutchin people as late as 1948. The Old Village Site, located downstream from the present village on Lower Birch Creek may have been occupied as much as 100 years ago (Slaughter n.d.). Slaughter also stated that he found several prehistoric site indications at the confluences of small lakes and outlets (Dale Slaughter, personal communication, 1987).

Prehistoric and late prehistoric use of the country by Native peoples was ultimately dependent on available resources. Prior to the coming of whites and the fur trade (with its emphasis on trapping and the need for fish to support dogteams) the major resource used in the upper Birch and Beaver Creek country was probably caribou. Following caribou would be moose, with lesser importance being placed on muskrat, beaver, fish, and waterfowl. Murray (1910), McKennan (1969), Osgood (1936), and Nelson (1973) have all described the varying importance of caribou among different Kutchin people. The importance and use of this resource is dependent on availability and the need for clothing and shelter.

The Kutchin or their immediate ancestors undoubtedly hunted caribou, either with the aid of dogs or with fences and snares, in the upland country drained by Birch Creek. Caribou and sheep hunting may have been important enough to support a few camps along Birch Creek. These small encampments would have been used as temporary bases during the seasonal subsistence cycle.

During the summer, these camps may have been the location of most fishing activity. Salmon are not common to Birch Creek but whitefish, grayling, northern pike, burbot, and sheefish were probably taken with traps (Osgood 1936). The Birch Creek National Wild River flows into the Yukon where salmon could be taken in quantities. However, before the fish wheel and modern net material were introduced by whites, most fish were taken with traps in the smaller streams and channels of the Yukon. After drying and caching fish, the late summer and fall would be the time to prepare for caribou hunts in the neighboring uplands. Moose could be taken at any time. It seems likely that people made use of winter base camps during the coldest months and depended on the cached fish or caribou. In the lean times of late winter and early spring, beaver and muskrat became increasingly important as food sources, which would necessitate hunting in the smaller lakes and ponds in the Yukon Flats. The return of water fowl to the Flats and their subsequent moult made them important prey in the early summer.

Of course, all wildlife resources are subject to cyclic fluctuations and changing migration patterns which could result in feast or famine and varying human populations. One would expect to find fish camps of a few family or band members along the lower courses of major streams of the Yukon, with satellite campsites or single hunting sites at strategic locations along Birch Creek and in the adjacent uplands.

These patterns were disrupted by increased dependence on trade goods and fur trapping. A prime factor in the seasonal cycle was trading, which usually meant being at Fort Yukon in early summer after its founding. Increased dependence on furbearers meant permanent traplines and a greater need for fish, preferably salmon, to feed dogteams. The dogteams provided increased mobility and more extensive traplines, with the fish camp becoming more settled. The importance of caribou hunting probably declined with a greater emphasis being placed on moose as a food resource.

3.8.3 Mining History

In 1863, Reverend Robert McDonald accompanied two natives from Fort Yukon to a site called "Kotlo" where they claimed the earth screamed like a human voice. They traveled 40 miles up the Yukon, crossed a portage to "Birch River" and descended the stream to a tributary called "Kootlonjok." The stream was "craggy and shoaled" and it took a day to ascend to "Kotlo," a 100-foot high hill with a waterfall, crumbling earth, and an abundance of fossils. McDonald found flakes of gold in a nearby stream (Ducker 1983).

Whymper (1868) reported that small amounts of gold had been found by some of the Hudson's Bay men near Fort Yukon, but not enough to warrant a gold rush.

In 1873, Jack McQuesten and some companions built a winter camp at the mouth of Beaver Creek, near Birch Creek, and prospected the vicinity. Although some gold was found, the quantities did not justify mining the area (Brooks 1953).

In 1893, two Russian-Natives, Pitka Pavaloff and his brother-in- law, Cherosky, panned for and discovered gold at Pitka's Bar at the confluence of Harrison Creek and Birch Creek. They returned to retrieve their families at Old Station on the Yukon, obtained a grubstake from McQuesten at Fortymile, and returned to 30 Mile or Old Portage on the Yukon where they wintered alone with approximately 100 white men who followed them. The next spring Pavaloff and Cherosky crossed over to Birch Creek where their following split up and began prospecting over the adjoining tributaries. Pat Kinneally, Jack Gregor, and Charley Colombe subsequently discovered gold on Mastodon Creek. Unfortunately, Pitka and Cherosky, who had staked their claims on Birch Creek, lost them due to their lack of knowledge about the filing process (Callahan 1975).

Both Manny Hill, who had the store at Old Portage, and Jack McQuesten from Fortymile, had established stores at the new log cabin community of Circle by 1894 (Callahan 1975).

In 1896, J.E. Spurr, H. Goodrich, and F.C. Schrader of the USGS made a trip into the Birch Creek country (Spurr 1900). Spurr describes Circle in August of 1896, before the Klondike boom, as containing" ...only a few hundred men... most of the miners being away at the diggings, for this was one of the busiest times of the year...."

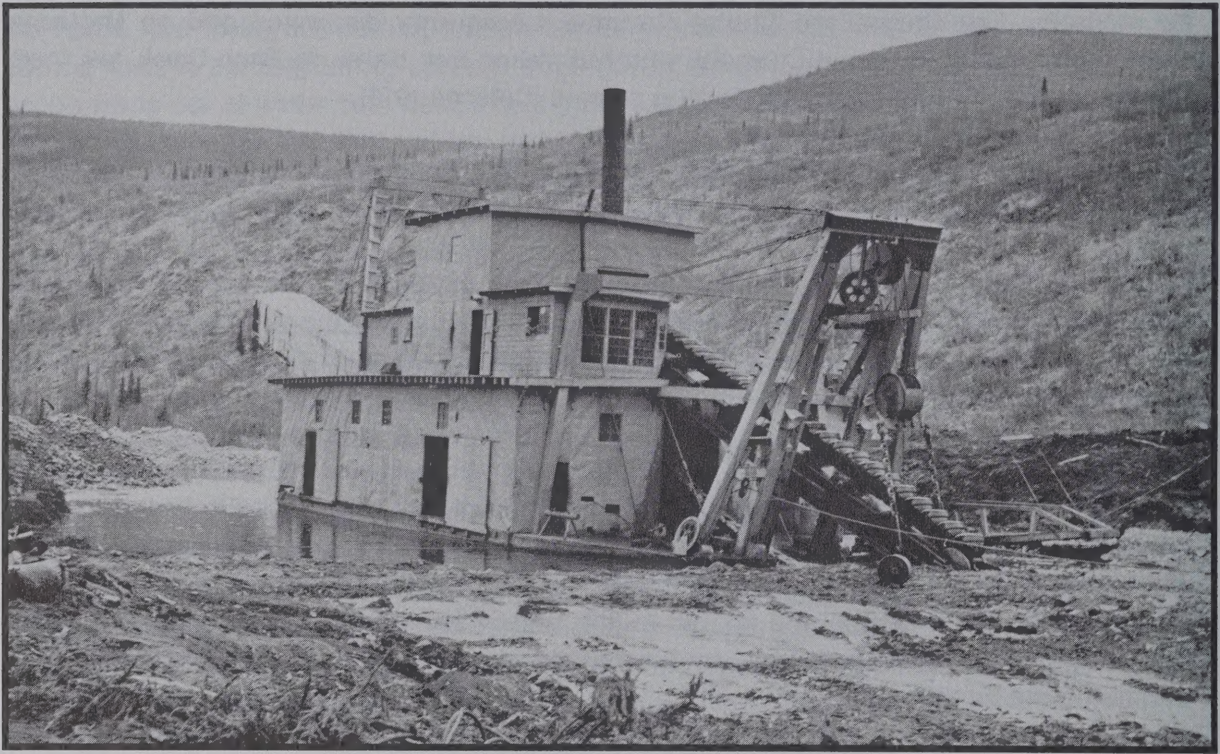
Although Pitka's Bar was the scene of early prospecting with goldpans and rocker boxes on the gravel bars, most prospecting in the Birch Creek district involved sinking holes to bedrock, where the heavy gold had settled out of the alluvial material. Thawing the ground was usually necessary and was done by wood fires, hot rocks, hot water, or steam points. The dirt was excavated with a pick, shoveled into a bucket, and hoisted to the surface with hand windlasses (Prindle 1906). Depending on the availability of water, the dump would then be sluiced and the gold collected from the riffles of the sluiceboxes.

Drift mining, where the deeper gravels were mined, involved sinking a shaft 20 to 120 feet, timbering the shaft and the horizontal drifts running from the shafts along the paystreak, then hoisting the gold-bearing gravel to the surface for sluicing (Prindle 1906). This technique, the most common one, was usually undertaken during the winter when the solidly frozen ground provided additional support, especially since wood was frequently scarce. The dump of hoisted gold-bearing gravel would then be sluiced during the summer when melted streams provided the needed water.

Open-cut mining was limited to the few locations where the gold- bearing material was shallow enough, mainly in the headwaters of the creeks. This was accomplished by removing the overburden and then constructing bedrock drains into which sluiceboxes were set. The boxes were either moved up the valley as material was sluiced in,or the gravel was hoisted into boxes which were set off to the side (Prindle 1906).

Mining was highly dependent on water availability, as much as or even more than the presence of gold. Prior to 1905, no extensive ditching was done, and any water used for sluicing came from the creek being mined (Prindle 1906).

Following the discovery of gold on the Klondike in 1897, many of the Birch Creek miners departed for Dawson, and the Birch Creek district was practically deserted. But many returned and, by 1906, Brooks estimated that about 200 men were at work on 60 to 100 claims (Brooks 1907).



Typical placer mining dredge, located on Jack Wade Creek, circa 1920's. Photo courtesy of the Anchorage Museum of History and Art.

Brooks also pointed out that it wasn't until 1906 that the claims began passing to the larger holding companies, which undoubtedly revolutionized mining methods in the area. Ditches were constructed in 1908 to provide water for hydraulic operations on Mammoth Creek (Ellsworth and Parker 1911). By 1909, a large hydraulic plant was operating on Eagle Creek and this mining technique came into serious use (Ellsworth and Parker 1911).

Dredges were later freighted into the district in the winter; C. J. Berry brought the first one into Mastodon Creek during the winter of 1911-1912 (Ducker 1983 and Eberlein et al 1977). Dredges were in operation on Mastodon also during 1918-1926, on Mammoth from 1915-1916 and 1936-1940, and on Deadwood from 1937-1938 (Eberlein et al 1977).

By the 1930's, bulldozers were introduced, although little mining activity was going on and most of it was by large companies. World War II closed down all mining in the district as non- essential to the war effort, and the government confiscated the heavy equipment. A few bulldozers were used after the war on Crooked, Deadwood, and Mastodon Creeks, but by the 1960's mining was virtually nonexistent due to the low price of gold. However, the rapid rise in gold prices by the 1970's saw renewed activity in the area. Such equipment as bulldozers and front-end loaders came into use to strip the overburden and push gravel into sluice boxes (Victor Ross, personal communication, 1983).

In addition to water availability, the mining operations were dependent on transportation to and from the creeks. Spurr, Goodrich, and Schrader hiked from Circle City to Birch Creek in 1896 via what "...was called a wagon road, the brush and trees having been cut out sufficiently wide for a wagon to pass; taken as a footpath, however, it was just fair...." (Spurr 1900). The several roadhouses located along the route included one at Twelve Mile where, for a dollar, travelers were ferried across the creek when the water was too high to ford. This roadhouse on the west side of the creek was Twelve Mile Cache, consisting of two long log houses facing each other, connected by their projecting log roofs. One was a sleeping room for travelers, the other was a kitchen and dining room (Spurr 1900).

Spurr and company traveled along the trail which "... ran for the whole distance through a swamp, and was said to be a very good trail in winter--in summer it was vile" (Spurr 1900). Although Spurr's party was informed of a higher trail from Central House, this section had not been completed as far as Twelve Mile by the time they embarked in August of 1896.

In 1898, George McManus had scouted a native trade route which ran between Circle and the Tanana valley. It appears that this route is now that of the Steese Highway (Ducker 1983). In the same year, Fred Currier sketched a map which showed both McManus' trail as well as another which went up the left bank of Deadwood, across Birch Creek and the headwaters of Columbus [Clums Fork] and down the Chena below the North Fork (Currier 1898). Another native trail ran along the South Fork to the Salcha (Ducker 1983).

By 1899, the higher section of the trail from Circle to Central became the main trail as Central became the supply point to the creeks. This section eventually became part of the Circle- Fairbanks Trail and then the Steese Highway. Spurr's party reached Jumpoff Creek while the roadhouse at that point was still under construction.

The Jumpoff Roadhouse had improved a little by the time Judge Wickersham made his dogsled trip in April of 1903, for he described a friend who drove his team "...into the Jumpoff barn lot, rubbed down his mule and slept on the kitchen floor in his blankets like a true stampeder." (Wickersham 1938). According to Behr, the old Jumpoff Roadhouse collapsed and eroded into Crooked Creek several years ago (Marsha Behr, personal communication 1983).

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Denver, CO 80225

Spurr's party continued on to the Hog'em Roadhouse the following day. This site at the mouth of Hog'em Creek was so named for the miner who tried to hog the claims by staking them in the names of his friends and relations. For the sake of propriety, the creek officially became known as Deadwood (Spurr 1900). Deadwood had a post office from 1906 until 1929, when it was moved to Central (Ricks 1965).

From Hog'em [or Deadwood], the trail separated to the diggings at the surrounding creeks. Spurr found most of the miners living in tents but they had "winter residences"; that is, small log cabins with pole and sod roofs in Circle where they spent the colder months.

In the 1890's provisions were packed in by the miners, Natives hired as packers, or by freighters with horses. Summer freight rates ran $40-$45 for a hundred pounds (Ducker 1983).

By 1905, the summer rate had dropped to $25 or $30 (Ducker 1983). But even by 1906, Brooks notes that "wagon roads are almost entirely lacking, and during the wet weather of the summer the horse trails become well-nigh impassable" (Brooks 1907).

Most freight and mail was brought in from Circle during the winter by dogteam or horses. Arthur T. Walden, who freighted with dogs out of Circle in the 1890's, used six or seven dogs. This team would pull as many as three sleds chained together with a total weight of as much as 1380 pounds or approximately 200 pounds per dog (Walden 1928).

When Judge James Wickersham took the blank recorder's books to the new mining camp of Fairbanks from Circle in April of 1903, he followed the winter sled trail that ran from the Twelve Mile Roadhouse to Jumpoff, Central, Miller's Roadhouse, across Eagle Creek to Twelve Mile Creek, then over the divide and into the Chatanika Valley (Wickersham 1938). This route was already in use by prospectors and freighters.

In 1908, ten miles of wagon road were built from Circle along this route. By 1909, the road extended to Central across the flats near the old Hog'em Trail.

In 1907, the Alaska Road Commission (ARC) built a winter sled trail from Cleary to Birch Creek and staked a summer trail on the adjacent ridge. The following year it was completed to Miller House, and by 1912 the wagon road ran to the mouth of Mammoth Creek (Ducker 1983). By 1928 the road was open from Fairbanks to Circle on a seasonal basis for light traffic and by 1933, two-ton trucks could pass over it (Ducker 1983)

In 1920, a road was built out of Central to the Deadwood mines and Circle Hot Springs where T. M. Leach, the proprietor of the Hot Springs, raised and sold vegetables to the Deadwood miners (Ducker 1983). Between 1933 and 1935, the ARC built a road from the Steese to Harrison Creek.

The Steese Highway has since been upgraded and is now maintained by the State of Alaska's Department of Transportation and Public Facilities (DOT/PF) to Circle on the Yukon.

Although trappers/prospectors and miners cabins, which generally date from the 1930's or later, can still be found throughout the area, most of these are collapsed ruins with few associated artifacts.

3.8.4 Paleontology

West (1965) noted that a bluff containing Pleistocene deposits located just downriver from the Steese Highway bridge between Central and Circle had yielded enough large mammal bones to receive the local appellation "Boneyard." Miners sluicing overburden from the creeks draining into Birch Creek routinely discovered bones from such Pleistocene fauna as mammoth, bison, and horse. A horse from this locality has been dated at just over 24,000 years old (John Cook, personal communication 1985). The 1983 BLM inventory of Birch Creek collected a fossilized Pleistocene caribou (*Rangifer sp.*) metatarsal from a gravel bar below Clums Fork. Past mining and prospecting probably had a significant impact on discovery and recovery of paleontological material in the smaller drainages, where most of the Quaternary alluvium exists. Most of the bluffs and outcrops along Birch Creek consist of weathered schist with little visibly eroding alluvial deposits.

3.8.5 Discussion

The existing knowledge of prehistory in Interior Alaska is limited. The remoteness of the country and relatively few sites, combined with dense vegetation and permafrost, make cultural resources generally difficult to find.

There is a curious relationship between mining and cultural resources. On one hand, mining has promoted understanding of the past because of artifacts collected from sluiceboxes, fossils exposed during hydraulic stripping, and site locations identified during exploration or prospecting. On the other hand, mining operations often destroy cultural material. Current mining practices are much more destructive than early-day techniques. And ironically, today's mining often destroys evidence of earlier mining which may, in itself, be of historic interest.

Most mining today takes place on previously disturbed ground. This trend is likely to continue for some time with the development of improved gold recovery techniques. Most of the damage to cultural and paleontological resources has probably already taken place in the drainages currently available for mining.

There are conflicts between Section 106 of the National Historic Preservation Act and the CFR. Section 106 requires that BLM identify all cultural resources that may be eligible to the National Register of Historic Places and allow for comment by the State Historic Preservation Officer (SHPO)(15 days) and Advisory Council of Historic Preservation (ACHP) (30 days) prior to allowing activity that may impact such sites (36 CFR 800). In contrast, 43 CFR 3809.1-6(5)(c) states that BLM or the operator shall have 30 days to complete an appropriate cultural resources inventory prior to approval of a Plan of Operations. Cultural resources are not covered under Notices other than under "undue or unnecessary degradation." Should cultural resources be discovered during operation under a Plan, the operator must leave the discovery intact and notify the Authorized Officer who has 10 days to remove or protect the resource before allowing the operator to proceed [43 CFR 3809.2-2(e)].

It is physically and economically impossible to locate and recover all cultural and paleontological resources prior to surface disturbing activity. However, if they were left permanently protected in the ground, we would have virtually no knowledge of prehistory in Alaska. Since locating these resources in river valleys is rare, frequent monitoring of mining operations and good working relationships with the operators have proven more effective in identification and recovery of inadvertently discovered cultural and paleontological materials. Education, crediting the discoverer, and making research or analysis results available to the public help protect and mitigate any adverse effects to such resources.

3.9 Subsistence

3.9.1 Introduction

Birch Creek and its tributaries, Harrington Fork, Clums Fork, Harrison Creek, Portage Creek, Crooked Creek, and South Fork, have been used for subsistence purposes by residents of Ft. Yukon, Circle, Central, Beaver, and Birch Creek village (Caulfield 1983).

ADF&G (1986a) has compiled statistics on socioeconomic profiles of Alaskan communities, including a population figure for Birch Creek village of 31 in 1984 with 97% Native Alaskan. There are no data on cash income or amount of subsistence use per capita. Fort Yukon had a population of 665 (71% Native), Circle 101 (74%), Beaver 65 (99%), and Central 35 (3%). Taxable income in 1982 in Circle was $16,876, in Fort Yukon $14.152, in Central $11,656, and in Beaver $7,856. The State average was $21,127. Per capita harvests of all subsistence foods are estimated at 862 pounds in Beaver, 255 pounds in Circle, 707 pounds in Fort Yukon, and 147 pounds in Central.

3.9.2 Subsistence Uses

The subsistence area used along Birch Creek extends from the Yukon River south along Birch Creek at least to Preacher Creek, west to Beaver Creek, east along Birch Creek and to the Yukon River. Many subsistence activities involve the entire village as participants, including use of a single fish camp on the Yukon River (Caulfield 1983).

Originally, Birch Creek village was used as a base for winter activities; summers were spent at a fish camp on the Yukon River. By the early 1960's, however, the village was used as a permanent habitation and base for almost all subsistence activities (Caulfield 1983). Birch Creek inhabitants participated in a seasonal round of subsistence activities (Caulfield 1983). Summers were spent in fish camps on the Yukon River catching and drying salmon for winter use, for both dog and human food. Before freezeup, people moved to winter residences to hunt moose, fish for whitefish, and hunt waterfowl. After freezeup, traps were set, and much of the winter was spent harvesting furbearers and preparing furs for trade. In the spring, after breakup, fish traps were set, and muskrats were hunted in the lakes and sloughs. Trapping achieved its importance in the subsistence round because of demand for furs throughout the world. The importance of trapping to the overall subsistence and trading economy of the Gwich'in depended on the price of furs (Caulfield 1983). Historically, the Gwich'in from Birch Creek hunted caribou from the Porcupine herd north of the Yukon River, and perhaps the Fortymile herd, southeast of the area (Caulfield 1983).

Gold was discovered in the Upper Yukon drainage in the 1880's and 1890's, and the influx of whites brought the Birch Creek area into the larger world. In 1892 gold was found on Birch Creek and three of its tributaries, Mastodon, Deadwood, and Mammoth Creeks (ADEC 1986). Originally, hand methods were used to extract gold, but hydraulic mining began as soon as the equipment could be moved in. By 1912, dredges were transported to Mastodon Creek from the Klondike and were used until 1941 in the Birch Creek drainage (ADEC 1986).

3.9.3 Affected Subsistence

In any subsistence economy it is necessary to be able to get to the resources. Because the Birch Creek subsistence area is in a lake and slough area, access by water is particularly important during the ice-free months. During the winter, snow machines can be used over a variety of terrain. The area has numerous sloughs and meandering streams that may also require portage. Low water years limit boat access upstream, especially beyond Preacher Creek (Caulfield 1983), and may also limit access into some of the shallower lakes and sloughs. Sedimentation of channels also limits access; e.g., in 1987, access from Birch Creek village into Two Island Lake (Subsistence Map One) was difficult because of sedimentation in the channel (Birch Creek Villagers 1987). The fact that 1987 was a low water year may have been a major cause of the difficulty of access, but residents note that siltation has increased throughout the area over the past few years, creating more filled channels.

Moose

Moose

Moose are an important subsistence item, not only for the amount of meat they produce, but also because much more of the animal is used than the meat, because meat is usually distributed among all the villagers, and because moose is a traditional food for funeral and memorial potlatches (Sumida and Alexander 1985, Olson 1981, Osgood 1936). Moose hunting is regulated throughout the state by the ADF&G. Birch Creek and Beaver residents subsistence hunt in Game Management Unit 25(d) west. Only subsistence hunting has been allowed in this unit since 1983-1984 (Sumida and Alexander 1985). Ten permits are issued in Birch Creek and 25 in Stevens Village. Reports from 1983 to 1985 show Birch Creek hunters harvested two moose in 1983-84 and three in 1984-85. Hunters from Beaver harvested seven moose in 1983-84 and 12 in 1984-85. Three periods of hunting were allowed in 1987-88: September 10-30, December 1-10, and February 18-28 (ADF&G 1987d). The moose hunting area extends from the

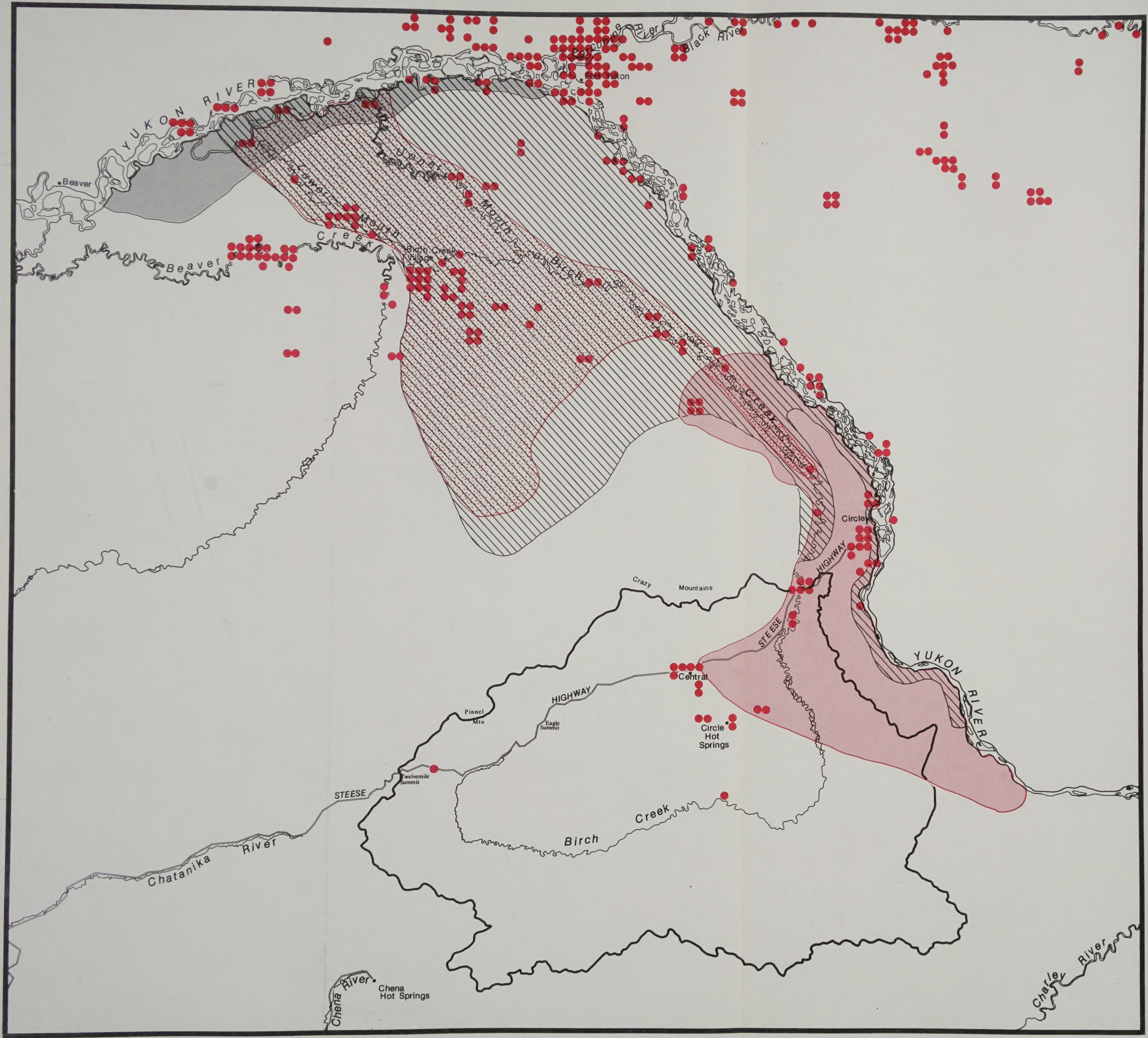
Steese Highway bridge across Birch Creek to the Yukon River (Subsistence Map Two), but if the water is low, hunting activity is centered from Preacher Creek downstream (Caulfield 1983, Sumida and Alexander 1985). Residents say they have averaged ten moose per year in the past (ADEC 1986), but in the past two years moose have been scarce along the usual hunting areas (Birch Creek Villagers 1987). The three moose harvested in 1985 were not a sufficient number for the population.

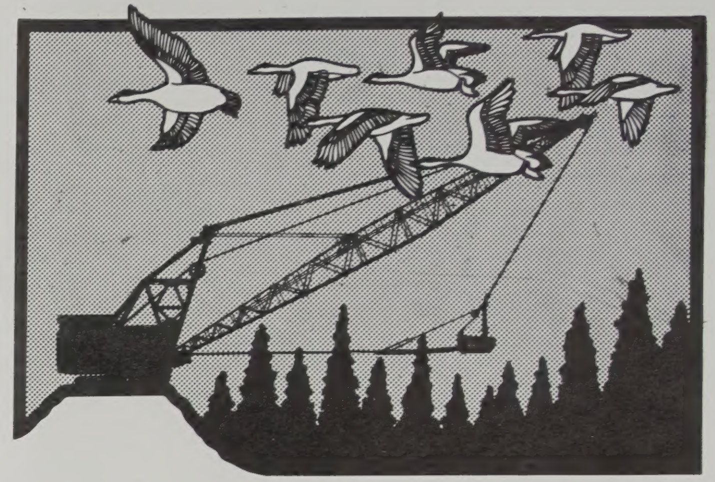
Moose habitat requirements are discussed in the wildlife section of this report. Residents of Birch Creek village (1987) reported seeing more moose in the area once mining operations were closed for the winter and the water began to clear. The Dames and Moore study (ADEC 1986) suggests that moose, and other wildlife, are affected by mining only in the actual mined area, which does not include the subsistence use areas on Birch Creek. Nevertheless, the moose habitat in the hunting unit is degraded, for reasons not clear.

Fish

Fishing occurs in the Birch Creek drainage, the Yukon River, and in the lakes and sloughs in the area (Subsistence Map Three). Salmon fishing occurs during the summer along the Yukon; most families have fish camps near the lower mouth of Birch Creek on the Yukon River (Caulfield 1983). Three species of salmon present are harvested. Residents indicate that the salmon harvest has

Many villages depend on fish for subsistence use. Courtesy of Bureau of Land Management.


YUKON RIVER
Beaver
Porcupine River
Black River
Fort Yukon
Lower Mouth
Upper Mouth
Birch
Beaver Creek
Birch Creek Village
Clear
Circle
HIGHWAY
STEESE
Crazy Mountains
Central
Circle Hot Springs
Pinnel Mtn
Eagle Summit
HIGHWAY
Twelvemile Summit
STEESE
Chatanika River
Birch Creek
YUKON RIVER
Chena River
Chena Hot Springs
Charley River



Birch Creek Placer Mining

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Cumulative Environmental Impact Statement

Subsistence Use Areas

1 of 3

and Native Allotments

General Resource Harvest Areas south of the Yukon River and within Birch Creek Drainage for the Villages of:
Beaver, Birch Creek, Circle, and Fort Yukon.

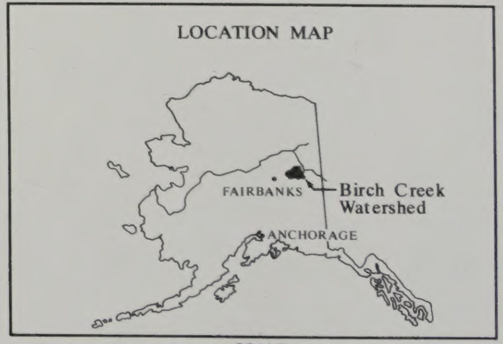
Data derived from ADF&G, 1986a

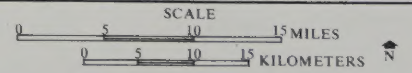
▨	**Beaver**	▨	**Birch Creek**
🟥	**Circle**	▨	**Fort Yukon**

● **Sites of Native allotments.**
Each symbol may represent more than one allotment.

NOTE:

Data for the communities came from the Alaska Department of Fish and Game, Division of Subsistance, which qualifies such maps by stating: 1. subsistence use areas depicted are based on information obtained from a sample of community households; 2. subsistence patterns of household resource use may change from year to year while information is collected for specific periods; 3. therefore all maps can be considered potentially only a partial representation of areas important to local village residents.


LOCATION MAP
FAIRBANKS
Birch Creek Watershed
ANCHORAGE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15 KILOMETERS
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Birch Creek **Placer Mining**

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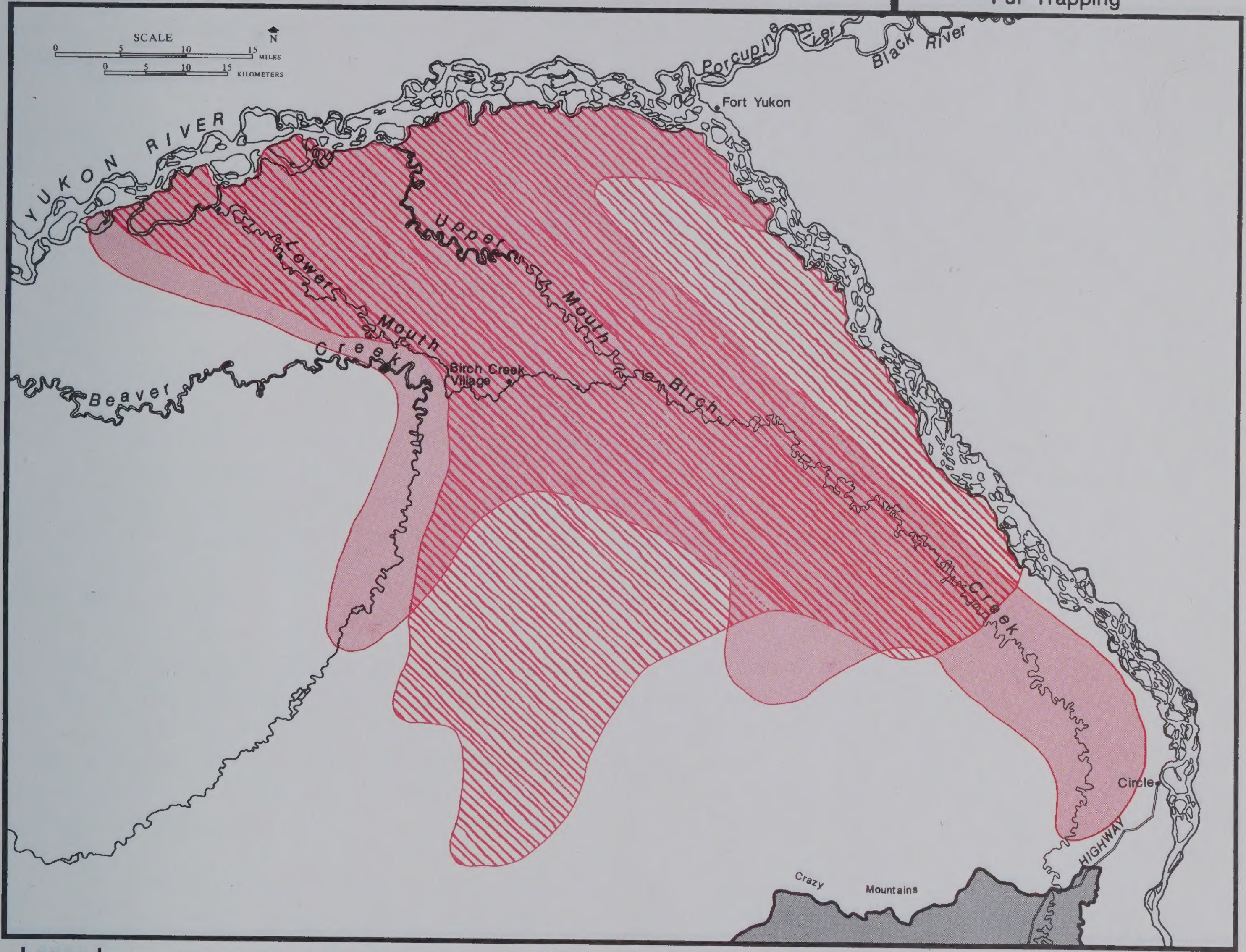
Cumulative Environmental Impact Statement

Subsistence 2of3

Subsistence Uses within Birch Creek Drainage: Moose Hunting Fur Trapping


SCALE
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YUKON RIVER
Porcupine River
Black River
Fort Yukon
Upper Mouth
Lower Mouth
Birch Creek Village
Birch Creek
Beaver Creek
Circle
HIGHWAY
Crazy Mountains

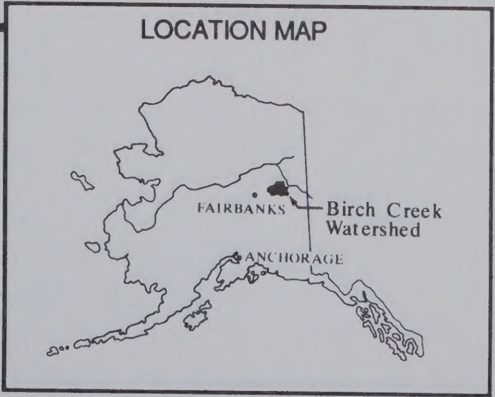
Legend

🟥 Birch Creek and Fort Yukon moose hunting area*

▨ Birch Creek and Fort Yukon fur trapping area*

⬛ Northern area of Birch Creek watershed

*from Sumida and Alexander (1985), Caulfield (1983) and Slaughter (n.d.)

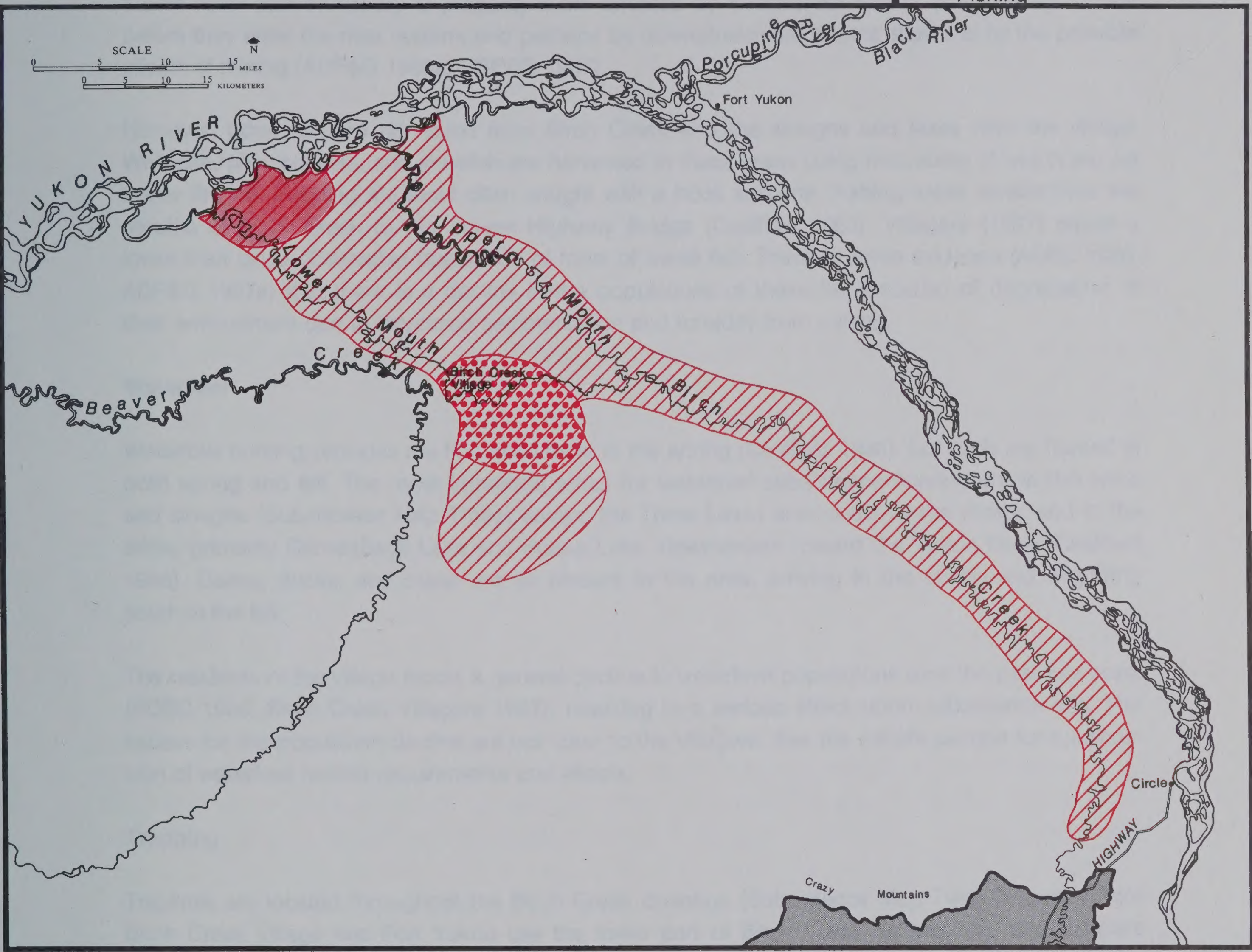

LOCATION MAP
FAIRBANKS
Birch Creek Watershed
ANCHORAGE

Note: Data for the communities came from the Alaska Department of Fish and Game, Division of Subsistence, which qualifies such maps by stating: 1. subsistence use areas depicted are based on information obtained from a sample of community households; 2. subsistence patterns of household resource use may change from year to year while information is collected for specific periods; 3. therefore, all maps can be considered potentially only a partial representation of areas important to local village residents.

Subsistence 3of3

Subsistence Uses Within Birch Creek Drainage:

Waterfowl Hunting Fishing

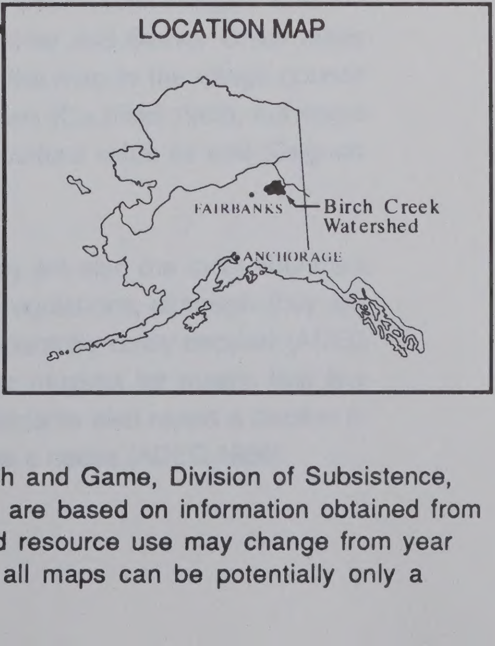

SCALE
0 5 10 15 MILES
0 5 10 15 KILOMETERS
N
YUKON RIVER
Porcupine River
Black River
Fort Yukon
Upper Mouth
Lower Mouth
Birch Creek
Birch Creek Village
Beaver Creek
Circle
HIGHWAY
Crazy Mountains

Legend

- 🟥 Birch Creek and Fort Yukon salmon fishing area*
- ● Birch Creek and Fort Yukon other fish species fishing area*
- ▨ Birch Creek and Fort Yukon waterfowl hunting area*
- ⬛ Northern area of Birch Creek watershed

*from Sumida and Alexander (1985), Caulfield (1983) and Slaughter (n.d.)

LOCATION MAP


FAIRBANKS
Birch Creek Watershed
ANCHORAGE

Note: Data for the communities came from the Alaska Department of Fish and Game, Division of Subsistence, which qualifies such maps by stating: 1. subsistence use areas depicted are based on information obtained from a sample of community households; 2. subsistence patterns of household resource use may change from year to year while information is collected for specific periods; 3. therefore, all maps can be potentially only a partial representation of areas important to local village residents.

declined in recent years. Dames and Moore's report (ADEC 1986) quotes a resident who usually caught up to 400 salmon (dates not stated, however) having a catch of 10-20 salmon in 1985. The Yukon River salmon fishery is probably more affected by commercial fishing of migrating salmon before they enter the river system, and perhaps by downstream catchment, than it is by the possible effects of mining (ADF&G 1986a, USFWS 1987).

However, other fish are harvested from Birch Creek and the sloughs and lakes near the village. Whitefish, pike, suckers, and sheefish are harvested in these areas using nets,some of which are set under the ice. Grayling are most often caught with a hook and line. Fishing areas extend from the mouths of Birch Creek to the Steese Highway Bridge (Caulfield 1983). Villagers (1987) report a lower than usual observable population of most of these fish. There is some evidence (ADEC 1986, ADF&G 1987a) that there is a decline in the populations of these fish because of degradation of their environment due to increased sedimentation and turbidity from mining.

Waterfowl

Waterfowl hunting provides the first fresh meat in the spring (Caulfield 1983), but birds are hunted in both spring and fall. The most important areas for waterfowl subsistence hunting are in the lakes and sloughs (Subsistence Map Three) toward the Three Lakes area south of the village, and in the lakes, primarily Canvasback Lake and Scaup Lake, downstream toward the Yukon River (Caulfield 1983). Geese, ducks, and crane are all present in the area, arriving in the spring and migrating south in the fall.

The residents of the village report a general decline in waterfowl populations over the past few years (ADEC 1986, Birch Creek Villagers 1987), resulting in a serious effect upon subsistence use. The causes for the population decline are not clear to the villagers. See the wildlife section for a discussion of waterfowl habitat requirements and effects.

Trapping

Traplines are located throughout the Birch Creek drainage (Subsistence Map Two). Trappers from Birch Creek Village and Fort Yukon use the lower part of Birch Creek for trapping, and trappers from Central and Circle use parts of the upper drainage (ADEC 1986). Birch Creek villagers also extend trapping use south toward the Crazy Mountains and in the Preacher and Beaver Creek areas as well as the Three Lakes area. There were nine traplines shown on the map in the village council office. Time and effort spent on trapping depends largely upon fur prices (Caulfield 1983), but some animals are used for food (e.g. muskrat), and some (e.g., wolf) have cultural value as well (Osgood 1936).

The most important furbearer specie, economically, is the marten; they are also the most abundant (ADEC 1986). Beaver are limited to 25 per trapper by Alaska game regulations, although they are relatively abundant in the area. Lynx and wolf are present, but are apparently rarely trapped (ADEC 1986). Muskrat are trapped and hunted, but the current low price for muskrat fur means that few people spend time hunting them, except for food (Caulfield 1983). Residents also report a decline in the muskrat population, with siltation of stream bank areas stated to be a cause (ADEC 1986).

Water

Birch Creek has been the primary source of potable water for the residents. However, once the village was occupied permanently, other solutions have been pursued, but with little success. The Bureau of Indian Affairs funded drilling of a well in 1967, but no water was found after drilling through permafrost for nearly 60 feet (ADEC 1986). A well drilled by the Public Health Service in 1975 also failed to find water, and finally a water point system was constructed in 1979, with water being pumped from Birch Creek, treated, and stored. However, a high level of lead from pipes was found and this system was abandoned, rehabilitated but not used, and finally abandoned again (ADEC 1986). At present, water is pumped from Birch Creek into the storage tank where people may obtain it for their homes. It is no longer treated, but residents are urged to boil or chlorinate their water.

Drinking water quality is of major concern to the residents of the village (Birch Creek Villagers 1987). During the public meeting at Birch Creek Village, there were examples given of sludge, slime, and bad odor coming from the water, present in the storage tank, or occurring in the home containers. It was also noted that after the mines closed for the winter, the water in Birch Creek became clearer, although waters throughout the area become clearer as runoff lessens in the fall. There was also concern over the use of flocculants to reduce turbidity in discharge from upstream mines, and a general perception that perhaps these chemicals were causing the problems with water (see the section on hydrology for further discussion).

Other Resources

Other resources utilized in the subsistence system of Birch Creek are plant foods, small game, and trees. Blueberries, cranberries, and other plants are available and utilized near the village in the flats area. Trees are utilized for heating or building; they are cut upstream and floated down to the village. Snowshoe hares, grouse, and ptarmigan are snared near the village (Caulfield 1983). There is no indication from the villagers that these resources are declining for any reason.

Native Allotments

Native allotments have been provided for by legislation dating back to 1906. The mayor in the village council office noted 32 allotments shown on the Subsistence Map One. Most are located in the Three Lakes area south of the village or downstream along the Lower Mouth of Birch Creek; however, some are in the Beaver Creek drainage or the Upper Mouth of Birch Creek (DOI 1987a). Allotments are used to sustain a variety of activities, including fishing, hunting, or maintenance of traplines.

Conclusions

Subsistence use along Birch Creek has been affected by declining populations of moose, fish, and waterfowl in particular, as well as decreased boat access to certain areas due to siltation. Water for village use is of poor quality, which causes concern among the villagers. There is a general perception among the people that conditions improve as soon as mines close for the winter. It is also possible that game management practices and regulations affect some animal populations, as well as natural fluctuations in water levels, precipitation, and climate. Opportunities for participating in a cash economy are limited in Birch Creek village, although not absent. There is no village store, and while no figures exist, it would seem that the major focus of the village is on subsistence.

3.10 Recreation and Visual Resources

3.10.1 Recreation Resource Values

The BLM has developed and approved two management plans specifically governing the management of recreation and scenic resources on BLM lands within the Birch Creek Watershed:

River Management Plan for the Birch Creek National Wild River. [DOI 1983b]

Steese National Conservation Area Resource Management Plan. (SNCA) [DOI 1986b]

All of the land use and management direction are subject to valid existing rights.

The preparation and implementation of these two plans was the result of several separate congressional designations which recognized unique values, including recreational and scenic resources, within the watershed.

After several studies, environmental impact statements, and one temporary administrative withdrawal, 126 miles of Birch Creek was designated as a component of the National Wild and Scenic River System, on December 2, 1980. ANILCA directed the DOI to prepare a management and development plan by December 2, 1983 and also to present the information to Congress by that date. The above-referenced River Management Plan was completed and now directs the BLM in the management of this river corridor pursuant to the Wild and Scenic Rivers Act, PL 90-542. The final EIS for the Proposed Birch Creek National Wild River-Alaska, [DOI 1974] identified the recreation and visual values of the proposed study area:

> "Birch Creek offers outstanding recreational opportunities for 'float boat' use for the experienced canoeist (canoeing, kayaking, rafting). It is one of the very few clearwater rivers in the state with road access at two points on an otherwise undisturbed river segment. The recreationist is offered a wilderness experience along the river without having to pay the high cost of aircraft--a unique proposition in Alaska."

> "The resources of the proposed Wild River Area are expected to attract increased numbers of recreationists in the near future. These resources provide excellent opportunities for fishing, hunting, nature study, photography, wildlife observation, wilderness camping, and hiking. Small quantities of gold at several tributaries and confluences present the opportunity for recreational gold panning. Several abandons [sic] trapping cabins lend themselves to historic interpretation."

The River Management Plan identified the following management objectives related to recreation and visual resources for the Birch Creek National Wild River.

- Preserve the river and its immediate environment in its natural, primitive condition.
- Preserve the free-flowing condition of the waters.
- Protect water quality and quantity.
- Provide high quality primitive recreation opportunities for present and future generations.
- Provide a variety of opportunities for interpretative, scientific, educational, and wildlands-oriented uses.
- Maintain and improve fish and wildlife habitat.

The Steese National Conservation Area was designated by Congress on December 2, 1980, in ANILCA for the purpose of establishing within the boundaries of the 1,200,000 acre area a program of multiple use and sustained yield, and for the maintenance of environmental quality. Special values noted in the establishment of this National Conservation Area are Birch Creek and caribou range.

In the Record of Decision on the SNCA, signed on February 2, 1986, management objectives and prescriptions for meeting the intent of ANILCA were listed. The recreation and visual resource related objectives for the NCA are:

- Maintain State water quality standard for the currently clear-flowing tributaries, such as Harrington Fork, Clums Fork, Sheep Creek, and South Fork Birch Creek.
- Manage Birch Creek and associated values in a manner consistent with the Birch Creek NWR Plan.
- Protect existing viewsheds along the Birch Creek NWR.
- Improve access to recreation opportunities.
- Provide for quality hunting, trapping, fishing and wildlife viewing.
- Protect primitive recreation values in the Mount Prindle/Lime Peak area and along the Pinnell Mountain Trail.
- Provide opportunities for ORV use in semi-primitive motorized management areas where compatible with fish, wildlife, and recreation objectives.

3.10.2 Visual Resource Values

Characteristic Landscape

The entire conservation area falls within the Yukon-Tanana Upland physiographic province. While the north Steese is essentially undeveloped, portions of the south Steese are covered by mineral claims. Mining development has and is occurring in the northern part of the south Steese and is believed to be increasing throughout the rest of the area.

Birch Creek ***Placer Mining***

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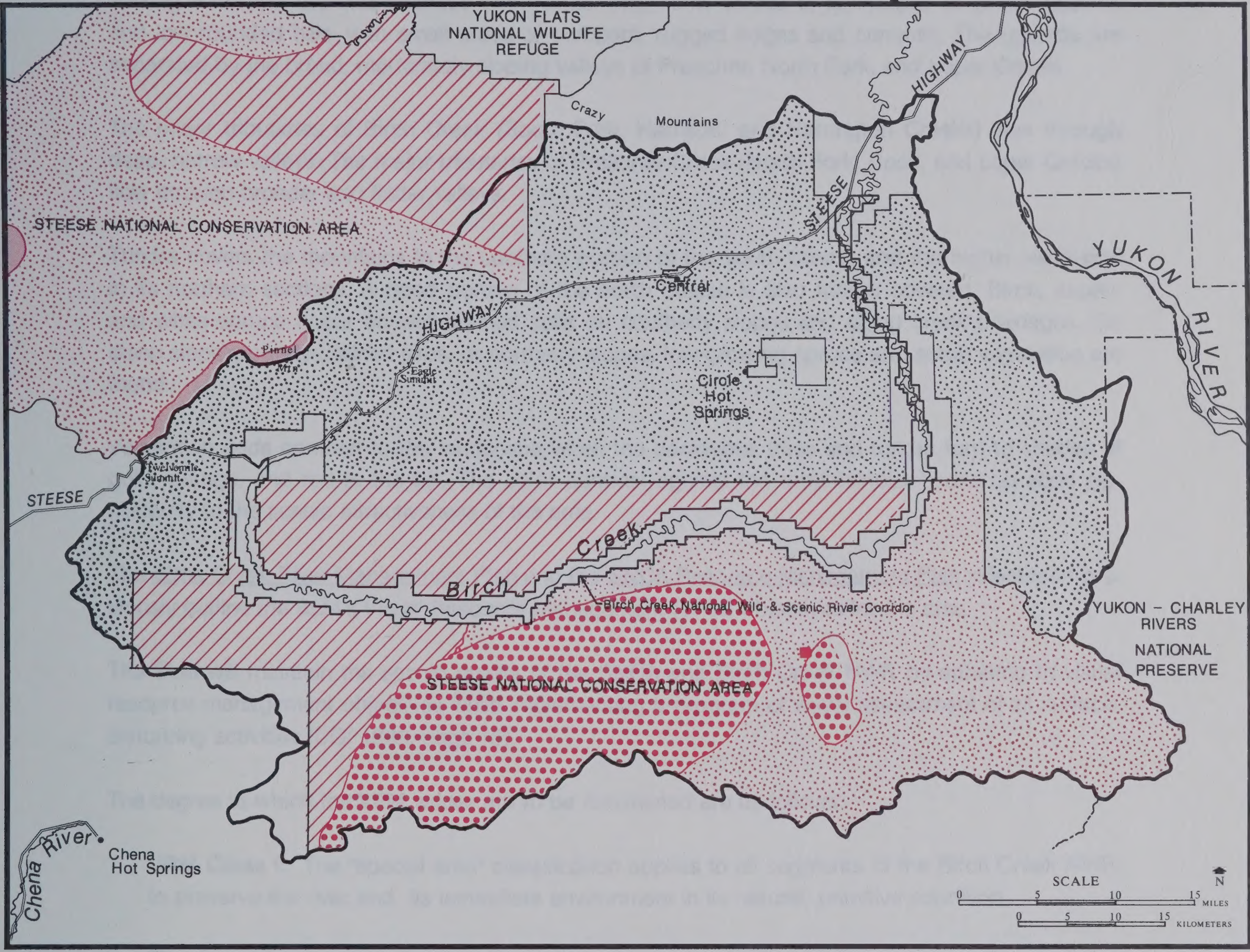
Cumulative Environmental Impact Statement

Recreation



YUKON FLATS NATIONAL WILDLIFE REFUGE
Crazy Mountains
HIGHWAY
STEESE
YUKON RIVER
STEESE NATIONAL CONSERVATION AREA
Central
HIGHWAY
Pinnell Mtn
Eagle Summit
Circle Hot Springs
Twelvemile Summit
STEESE
Birch Creek
Birch Creek National Wild & Scenic River Corridor
YUKON - CHARLEY RIVERS NATIONAL PRESERVE
STEESE NATIONAL CONSERVATION AREA
Chena River
Chena Hot Springs
SCALE
0 5 10 15 MILES
0 5 10 15 KILOMETERS
N

Legend

Management Units*

■ Research Natural Areas. Managed by BLM to protect scientific values.

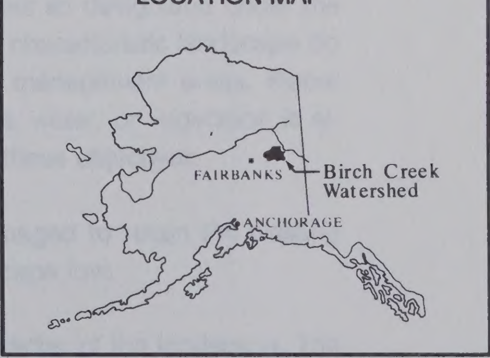
🟥 Primitive. Managed by BLM to provide recreation opportunities in areas characterized by essentially unmodified natural environment.

Semi-primitive Motorized. Managed by BLM to provide recreation opportunities in areas characterized by mostly unmodified natural environment:

- ▨ Open to entry under the 1872 Mining Law
- ░ Open to entry under the 1872 Mining Law but subject to special stipulations
- ● Closed to entry under the 1872 Mining Law

⁘ Lands tentatively approved for conveyance to the State of Alaska. See Status map.

LOCATION MAP



FAIRBANKS
Birch Creek Watershed
ANCHORAGE

*The Steese Mountains NRA Management Units depicted on this map are based on the "ROD RMP for SNCA" 2-6-86.

The landforms of the south Steese are defined primarily by the Birch Creek drainage. Lower, rounded mountains and hills with intrusions of bedrock which have been shaped and dissected by flowing water are the characteristic land forms. The north Steese is composed of gentle uplands and low rounded hills, with small areas of compact, rugged ridges and summits. The uplands are separated by the broad, moderately sloping valleys of Preacher, North Fork, and Loper Creeks.

The major tributaries of Birch Creek (South Fork, Harrison, and Harrington Creeks) flow through deep, narrow valleys. The major tributaries of Preacher Creek (North Fork, Rock, and Loper Creeks) flow through broader and flatter valleys.

Tundra covers the mountains in the southern portion of the south Steese and the higher elevations in its northern sections. A good portion of the north Steese is also tundra covered. Birch, aspen, and white spruce occur on well-drained soils on southerly slopes and along creek drainages. On steep slopes, poorly-drained sites, or northerly slopes, low-growing spruce and scrub vegetation are found.

Vegetation adds contrast to the landscape when the deciduous trees and tundra turn to shades of gold, orange, and red in the fall. The color contrast against the mountainous backdrop adds significantly to the scenic attractiveness of the area.

The Birch Creek River Management Plan and the SNCA Resource Management Plan referenced previously outline the BLM's Visual Resource Management (VRM) objectives for the area.

The BLM will maintain the scenic quality of the SNCA and Birch Creek NWR by adhering to visual resource management objectives while implementing a program of visual assessment of all surface-disturbing activities (DOI 1986, page 15).

The degree to which the VRM values are to be maintained are as follows:

> **VRM Class I:** The "special area" classification applies to all segments of the Birch Creek NWR, to preserve the river and its immediate environment in its natural, primitive condition.
>
> The current and approved Birch Creek River Management Plan of December, 1983 specifies a VRM classification of "special area" applying to all segments of rivers so designated under the WSRA. Past or present activities which have altered or will alter the characteristic landscape do not meet the Visual Resource Management objectives for Class I management areas. Placer mining, road construction, and other similar activities where the soil, water, or vegetation is altered from the natural appearing landscape are not compatible with these objectives.
>
> **VRM Class II:** The critical viewshed from Birch Creek NWR is managed to retain the existing character of the landscape, keeping the level of change to the landscape low.
>
> Within VRM Class II areas the objective is to retain the existing character of the landscape. The level of change should be low. Placer mining and the associated roads, vegetation removal, and soil disturbances alter the characteristic landscape and are therefore in conflict with the

management objectives of VRM Class II areas (subject to valid existing rights and 43 CFR 3809 management standards). Placer mining is taking place within the drainage bottoms where the landscape is visually sensitive, highly noticeable, and the highest visual interest in the landscape. This is caused by a combination of observer position, sensitivity levels and dominance factors which draw the eye to the area disturbed by mining and associated activities.

VRM Class III: The remainder of the SNCA (excluding the critical viewshed of Birch Creek, which is being managed for multiple use, including for semi-primitive motorized recreation opportunities) will be managed to partially retain the character of the landscape, with levels of change being moderate, but not dominating the view of the casual observer.

Within VRM Class III areas modification of the characteristic landscape can occur, however, it should be moderate and should not attract attention or dominate the view of the casual observer. Mining activity in these areas is allowable, but would have to be judged on a case-by-case basis. Cumulatively they create a significant impact on the scenic quality of the area as they visually dominate the characteristic landscape, are highly evident to the casual observer, and significantly affect the visual quality of the water flowing through the Birch Creek Wild River.

Presently there are no State plans for their portion of the Birch Creek watershed.

3.10.3 Existing Recreation Facilities

At the present time, the only existing facility located within the boundaries of the defined area is the Pinnell Mountain National Recreation Trail. This 27-mile summer hiking trail begins and ends on the Steese Highway and traverses approximately 18 miles of the SNCA.

Recreation Facilities within the general vicinity of the SNCA are shown in Figure 3-4.

Facility	Land Manager	Description
Eagle Summit	BLM	Parking access to SNCA Mt.
Twelve Mile Summit	BLM	Parking access to SNCA
Mile 94-Steese	BLM	Put-in for Birch Creek NWR
Bedrock Creek Campground	BLM	Unit semi-developed
Ketchum Creek Campground	BLM	Unit semi-developed
Circle Hot Springs	Private	Resort hotel
Central Campground	Private	RV/tent campground

Figure 3-4. Recreation facilities within the general vicinity of the SNCA.

Birch Creek Placer Mining

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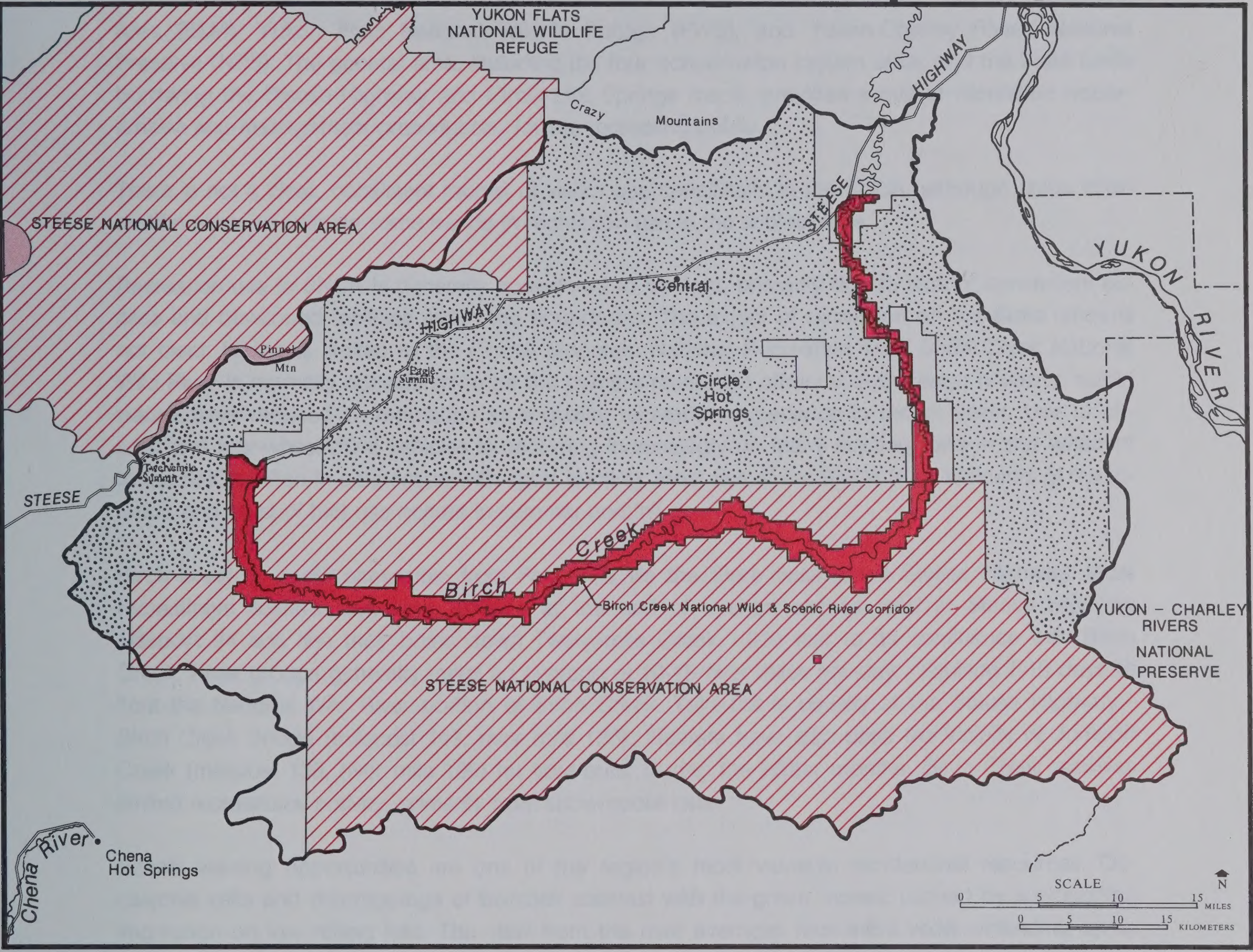
Cumulative Environmental Impact Statement

Visual Resource Management


YUKON FLATS NATIONAL WILDLIFE REFUGE
Crazy Mountains
HIGHWAY
STEESE
STEESE NATIONAL CONSERVATION AREA
Central
HIGHWAY
Pinnell Mtn
Eagle Summit
Circle Hot Springs
Twelvemile Summit
STEESE
Creek
Birch
Birch Creek National Wild & Scenic River Corridor
YUKON RIVER
YUKON - CHARLEY RIVERS NATIONAL PRESERVE
STEESE NATIONAL CONSERVATION AREA
Chena River
Chena Hot Springs
SCALE
N
0 5 10 15 MILES
0 5 10 15 KILOMETERS

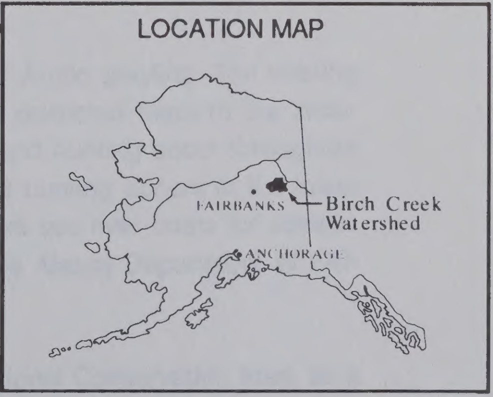
Legend

🟥 Visual Resource Management Class I*
-preserves existing character of landscape so that it appears unaltered by man.

■ Visual Resource Management Class II*
-retains existing character of landscape with only low levels of change by man.

▨ Visual Resource Management Class III*
-allows moderate modification of characteristic landscape that does not attract attention nor dominate view.

░ Lands tentatively approved for conveyance to the State of Alaska. See Status map.


LOCATION MAP
FAIRBANKS
Birch Creek Watershed
ANCHORAGE

*Areas that are determined to be within the critical viewshed for the Yukon Flats National Wildlife Refuge will be managed by VRM Class II objectives.

Note: With the exception of the Birch Creek National Wild River Corridor, VRM classes shown are for the Steese NCA only.

3.10.4 Recreation Visitor Use

The SNCA borders three National Conservation System units: White Mountains National Recreation Area (BLM), Yukon Flats National Wildlife Refuge (FWS), and Yukon-Charley Rivers National Preserve (NPS). The general area, including the four conservation system units, and the State lands bordering the Steese Highway and Circle Hot Springs roads, provides a mix of recreation opportunities and management prescriptions for the recreating public.

There is not a clear, consistent record of visitor use specifically in the SNCA, although some information exists to indicate some trends in recreation use in the subject area.

Recreation use in SNCA is generally considered to be light, primarily due to lack of convenient access and developed facilities within the boundaries. The extent of recreation on the State lands is not clear. Hiking is limited to the Pinnell Mountain National Recreation Trail. Birch Creek National Wild River is normally considered to be the primary recreation attractor in the area; however, turbid waters have reduced its reputation as a quality recreation experience in recent years. Use of off-road and four-wheel drive vehicles is occurring increasingly on many existing trails in and adjacent to the SNCA, often in connection with sport hunting. Most use of the SNCA is by residents of the Interior, and most of that use occurs in summer and fall.

Birch Creek is easily accessible from Fairbanks via the State- maintained Steese Highway. Most recreational floaters park their vehicles at the end of a short access road at Steese Highway Milepost 94 and line their boats down Twelvemile Creek 1,000 feet to its confluence with Birch Creek. River groups generally travel an average of 10-15 river miles per day, requiring 7-10 days to float the National Wild River portion of Birch Creek. Take-out is usually at the Steese Highway - Birch Creek Bridge (milepost 147, river mile 126). Floaters have also used the vicinity of Jumpoff Creek (milepost 139, river mile 109) for take-outs. During the winter months, Birch Creek receives limited recreational activity, primarily from snowmobile use.

Scenic viewing opportunities are one of the region's most valuable recreational resources. Occasional cliffs and outcroppings of bedrock contrast with the green mosaic formed by surrounding vegetation on low rolling hills. The view from the river averages four miles wide, extending up to eight miles at some locations.

Birch Creek is known to have supported an excellent sport fishery for Arctic grayling. The existing turbid water has significantly reduced sport fishing opportunities and restricted them to the clear-water tributaries of Birch Creek. Opportunities for wildlife observation and hunting occur throughout the area. While float- boating provides access for some hunters, most hunting occurs in the lower portion of the National Wild River and Yukon Flats NWR, where hunters use river boats for access. Trapping also occurs within the river corridor, and is regulated by the Alaska Department of Fish and Game. Access for trapping is primarily by snowmobile.

Figure 3-5 shows the estimated visitor use for Birch Creek and the National Conservation Area, as a whole.

Though recreation use data available for SNCA and Birch Creek NWR are not consistently reported and the reliability is low, recreation professionals, in reporting total estimated use for the two nationally designated areas seem to be indicating some trends. Recreation visitor days in SNCA, as a whole, are increasing, with a trend toward motorized recreation use according to RMIS statistics, 1984-1987. However, recreation visitor days in Birch Creek National Wild River declined between 1974 and 1979, just prior to designation. Use seems to have leveled off at approximately 1,000 visitor days per year.

Birch Creek

Activity	1973	1979	1984	1987	Carrying Capacity
Boating	950		33	25	3,000
Camping	1,000		300*	500*	3,700
Fishing	400		100	100	1,400
Hunting	200		200*	200*	800
Other Activities	150		100*	100*	2,000
Total	2,700	1,000	733	925	10,900

Steese National Recreational Area (including Birch Creek)

Activity	1984	1987
Boating	33	25
Camping	500	1,000
Fishing	100	100
Hunting	2,500	3,500
Site Visits	0	1,670
Hiking	100	130
Winter Sports	667	1,170
ORV Use	1,250	2,900
Other motorized	0	280
Total	5,150	10,775

*This represents the estimated portion of the total visitor days for Birch Creek reported in Recreation Management Information System Data-1984 & 1987 for the entire Steese National Recreation Area.

Figure 3-5. Estimated recreation visits. Figures are from the BLM files.

This drop in visitation was documented in "A Proposal for Protection of Eleven Alaskan Rivers" (DOI 1980a, b) which described some changes in the conditions: "Upstream mineral activity since the 1975 EIS has clouded Birch Creek to the extent that some parties have decided not to float the stream.....The rising price of gold has brought renewed interest in gold mining operations within and adjacent to the river corridor. Activity on the tributary streams has resulted in their siltation which in turn has silted the entire main stem with this proposal. Birch Creek itself is also being used as an access route to some of the tributary claims." [pg. III-7]

3.10.5 Economic Value of Recreation

The economic value of recreation is difficult to assess, primarily because no specific studies have been conducted on the recreation value of this specific watershed, and the recreation visitor use statistics for the SNCA (including Birch Creek) are considered to be of low validity [RMIS, 1984, 1986, 1987], based on "best guesses" of the district BLM recreation specialists.

	Visits	Visitor days	Value	Computed standard
Boating	50	20 X	Standard value $10	= $200
			Less than standard value $5	= $100
Fishing	300	100 X	Standard value $11	= $1,100
			Less than standard value $11	= $1,100
Hunting	6,000	3,500 X	Standard value $41	= $143,500
			Less than standard value $41	= $143,500
Camping	600	1,000 X	Standard value $6	= $6,000
			Less than standard value $3	= $3,000
Site Visits	6,000	1,600 X	Standard value $9	= $14,400
			Less than standard value $5	= $8,000
Non-motorized	400	130 X	Standard value $9	= $1,170
			Less than standard value $5	= $650
Winter Sports	3,500	1,200 X	Standard value $10	= $12,000
			Less than standard value $5	= $6,000
Motorized Travel	6,750	3,300 X	Standard value $8	= $26,400
			Less than standard value $4	= $13,200
Total	23,600	10,850	Total standard	= $204,770
			Total less than standard	= $175,550

Figure 3-6. Estimate of the economic value of recreation in the Steese National Conservation Area (SNCA).

In 1979, the Department of Interior, in the 204(c) EIS, estimated the recreation dollar value for uses associated with Birch Creek river corridor (rafting, canoeing, fishing, camping, and nature study), to be equal to $16.00 per user day. The DOI study team recognized the values assigned exceeded those permitted under Water Council Guidelines, but justified this amount based on the high transportation costs associated with Alaska (page VII-4). For Birch Creek river corridor alone, the recreation dollar value was estimated at $16,000.

Figure 3-6 displays the 1987 recreation dollar value based on user day valuation and the standard recreation dollar values for recreation uses for the entire Steese National Conservation Area, including Birch Creek NWR Corridor.

These values reflect only an estimate of the value of actual recreation use of the drainage, in its present condition. Since user day valuation is based on the number of visitors and length of stay, the decrease in use on Birch Creek represents a decline in the value of the primitive recreation experience since 1974. In a like manner, if visitor use statistics were available, the increase in use in the remainder of the SNCA represents an increase in the semi-primitive motorized recreation experience.

Further discussion on the methodology used in determining recreational values is in Appendix C-2.

3.11 Economics

The following discussion is taken from a report by the Alaska Department of Commerce and Economic Development - Office of Mineral Development 1986 entitled "The Role of Placer Mining in the Alaska Economy 1985."

> "Expenditures by Alaska placer miners for labor, goods, and services were approximately $75 million in 1985. Of these expenditures, $63.4 million were made in Alaska. About 36% of the total expenditures were made in Fairbanks, and 31% of the workers reside there. Anchorage also plays an important role in the placer mining industry, accounting for 23% of the expenditures and 16% of the work force. Placer mining is a major contributor to the economy of rural Alaska as 34% of the work force comes from rural Alaska and 18% of the total expenditures are made in small communities around the state. Washington and other states play a smaller role in the industry, accounting for 15% of the expenditures and 19% of the labor force.
>
> "Direct employment in the industry is approximately 10,000 person-months and an estimated 2,226 people are involved in the industry on at least a part-time basis. If direct employment is added to this figure, the total employment by the 410 active placer mining operations is estimated to be 20,136 person-months or 1,678 person-years.
>
> "The placer mining industry has a significant indirect impact on the Alaska's economy. The $63.4 million of statewide expenditures had a total impact on sales in the Alaska economy of $127.4 million. The income multiplier results in total wages and salaries resulting from placer mining of $33 million and an estimated 841 people are employed by support industries serving placer mining. These figures demonstrate the importance of placer mining in the Alaska economy."

"Analysis of the input-output models allows estimation of the output, income, and employment multipliers showing the total impact on the economy resulting from placer mining. These multipliers are:

	Output	Income	Employment (per $ million)
Alaska	2.01	2.54	26.5
Fairbanks	1.71	2.14	23.1
Anchorage	1.88	2.49	25.9

"The output multiplier shows the total dollar sales in the economy due to each dollar placer miners spend in Alaska. It allows calculation of the total sales in the economy due to placer mining. These sales are the sum of the placer miners' expenditures and the expenditures made by their suppliers to meet the miners' needs. It includes all rounds of spending.

"The income multiplier shows the total wages and salaries paid in the economy for each dollar placer miners spend on payroll. It allows calculation of the total salaries and wages paid in the economy due to placer mining, including the initial payroll expenditures by the miners and the payroll of mining support firms that is attributable to placer mining.

"Similarly, the employment multiplier shows the total employment in the economy for each million dollars in the in- state expenditures made by placer miners. It allows calculation of the total employment in the economy due to placer mining. It includes both the direct employment at placer mines and the employment due to sales to placer miners.

"The multipliers are different for each region due to both varying degrees of self-sufficiency and different types of expenditures by placer miners. Since the Fairbanks economy is less developed than that of Anchorage, there is more "leakage" from the region and so the multipliers are lower.

"Based on these multipliers, the total impact on sales in Fairbanks is about 446 million, in Anchorage about $32 million, and in the state as a whole, $127 million. The total impact on salaries and wages in Fairbanks is $9.5 million, in Anchorage $5.5 million, and about $33 million in Alaska. The total impact on employment in Fairbanks is about 625 full-time employees, in Anchorage about 438, and in Alaska 1,678."

Current Status

The number of placer mining operations in Alaska has declined from 1985 to 1986 and from 1986 to 1987, while the price of gold has gone up and gold mining activity in the rest of the world has gone up. From 1985 to 1986, Alaska gold production decreased 16%, the number of placer mines decreased 27%, 385 Alaska placer mining jobs out of about 2,000 statewide were lost, and the eastern Interior region saw a 49% drop in mining employment.

A major reason for the decline in Alaskan placer mining is the complexity and uncertainty of present and future regulatory requirements, the financial liability associated with these requirements, and the cost of complying with standards. The number of potential permits and approvals required translate into time and expense for the miner. The monetary risks associated with enforcement of current criteria are high, i.e. violators may be subject to $25,000 per day fines. Only those mines having no discharge and those discharging into a large receiving stream can consistently meet the turbidity criteria. Miners carefully consider whether they should borrow capital or buy equipment that will take years to repay if there is a chance they will be shut down in the near future.

The current injunctions affecting BLM land could cause an economic hardship on miners using five or more acres. The loss of the 1988 mining season may force some mines out of business if they lose equipment and experienced work crews, and are unable to repay loans.

In addition, a miner's decision to operate in the future would be based on the economic principle that a facility's revenues must cover the operating costs. Mine closures would be likely if an operation cannot produce sufficient revenues to cover operating costs.

The decision to operate cannot be made in isolation, and, therefore, a projection of economic loss is not sufficient for closure decisions. Included in the decision to operate are considerations of price expectations, individual operating costs, uncertainty of regulatory controls, closure and restart costs, financial status, and tax loss advantages.

Birch Creek watershed is sparsely populated. The Central/Circle Hot Springs portion of the area is the most populated with 42 residents. Just north of the drainage is Circle City with a 1985 population of 94. Population is expected to grow at a relatively rapid rate since these communities are based on mining and are on a road. The Birch Creek village lies outside the study region near the mouth of Birch Creek. Its population is projected to be less than 50 through the year 2000.

Total expenditures by mines in the region are estimated to be over $8.9 million. This is 17% more than the estimated value of the gold produced in the region. Labor costs (wages) amounted to an estimated $1.9 million in 1985.

The area's proximity and easy access to Fairbanks is reflected in the high proportion of expenditures made in Fairbanks ($7 million in 1985). Over 75% of these expenditures are made in Fairbanks. Only 1.48% of expenditures are made in Anchorage. This compares with the statewide average of 22.6%. Expenditures in rural Alaska are 8.8% of the total compared with a statewide average of 18.3%. In 1985, Birch Creek mining expenditures were an estimated $7.9 million within the Alaska economy (Hagler, Bailly & Co. 1987).

Employment in the placer mining industry in the Birch Creek drainage has fluctuated widely with a dramatic increase in the early 1980's and a recent decline. According to Bundtzen (1987), there were 240 persons employed in placer mining in 1985. Data from a survey conducted in 1985 estimated 1,261 person-hours of labor used. Using the average for Alaska, this translates into about 289 employees. Most of these would be employed only during the mining season.

Based on employment hours worked, a greater percentage (48%) are from Fairbanks than any other area. Approximately 21% are from rural Alaska, less than 5% are from Anchorage, and about 27% from outside Alaska (ADEC 1987a).

Total employment in 1985 (direct plus indirect) due to placer mining was estimated to be about 160 within the Fairbanks economy and 210 within the Alaska economy.

Early Interior Alaska mining family. Photo courtesy of Anchorage Museum of HIstory and Art.

BIRCH CREEK

Chapter IV
Environmental Consequences

Section Page

4.1 Geology and Topography........ 4 – 2
4.2 Mineral Resources........ 4 – 5
4.3 Soils........ 4 – 7
4.4 Water Resources........ 4 – 12
4.5 Landcover........ 4 – 19
4.6 Wildlife........ 4 – 29
4.7 Fisheries........ 4 – 44
4.8 Cultural Resources........ 4 – 52
4.9 Subsistence........ 4 – 54
4.10 Recreation and Visual Resources........ 4 – 63
4.11 Economics........ 4 – 69
4.12 Mitigation........ 4 – 72

This chapter discusses the potential consequences or impacts of each of the alternatives described in Chapter Two. The intent of this chapter is to provide the scientific and analytical basis of the comparison of the alternatives (Figure 2-5).

Cumulative Impacts

The evaluation of cumulative impacts requires the integration of time, space, mining/non-mining, and federal/non-federal actions in a complex and dynamic environment. The spatial aspect is covered by considering the impacts of multiple mining operations in the Birch Creek drainage (Placer Mining Operations and Access Roads Map, Chapter Three). Time is considered by evaluating the past, present, and reasonably foreseeable actions of placer mining. Past and present impacts are part of the existing environment, discussed in detail in Chapter Three, Affected Environment. The projected number of mines, acreages of disturbance, and miles of roads and trails were calculated using methods outlined in Appendix B-1, and are summarized in Figures 2-2, 2-3, and 2-4. Future impacts are discussed in this chapter, Environmental Consequences. Impacts from non-federal mines are included in the discussions of current environment and projected impacts. In particular, the impacts of Alternative D, no mining on federal claims, shows the effects from mining on State and private mines. Non-mining actions are discussed in Chapters Three and Four as appropriate.

For a summary of the impacts and comparison between alternatives, reference Figure 2-7, which depicts past, 1987, and projected 1998 impacts for the Proposed Action and each alternative.

Projection of Mines

Eighty mines (48 federal and 32 State and private mines) were projected to be operating in the Birch Creek drainage over the next ten years under the Proposed Action. This number was determined by using a one-to-one relationship between the 1987 price of gold and the number of mines operating during 1987 to predict the number of mines expected to be operating in 1998 with an estimated gold price of $600 per ounce. This estimated gold price was approximately a 23% increase over the highest 1987 price of $475 per ounce, so a corresponding increase in the number of mines was projected for 1998. This level of mining activity was projected so that the cumulative environmental effects of increased mining activity within the drainage could be assessed.

Projecting the number of mines that would operate under Alternatives A, B, and C was based on the compliance costs of these alternatives as compared to the Proposed Action's compliance costs. These costs are listed in Figure 2-6, and a comparison clearly indicates that the estimated water treatment costs for Alternatives A, B, and C are significantly higher than those estimated for the Proposed Action. Due to these significant increases in compliance costs, BLM estimated that there would be a reduction in the number of mines operating under these alternatives. Under Alternatives A and B, 70 mines (42 federal and 28 State and private mines) were estimated to be operating in 1998. Similarly, 58 mines (35 federal and 23 State and private mines) would operate under Alternative C due to additional increases in water treatment and reclamation costs. These reductions are discussed further in the following paragraph. Under Alternative D, no federal mines would be operating, while 32 State and private mines would be operating under the standards of the Proposed Action.

The water treatment costs cited in Figure 2-6 were taken from an EPA report (EPA 1987a) that analyzed the economic impact of effluent standards on the placer mining industry. In the EPA report, six water treatment technology options were outlined and their associated costs for Alaska were estimated. BLM reviewed these options and selected the three treatment technologies that came closest to meeting the various water quality standards of the Proposed Action and Alternatives A, B, and C. The Proposed Action treatment technology would be a simple settling system that consists of primary and secondary settling ponds operated with an EPA variance for turbidity discharge, similar to treatment technology option two. Alternative A and B, with water quality standards of .2 ml/l settleable solids and the 5 NTU turbidity standard, and no EPA variances, would require operating with no seepage of effluent to the stream, or the option four water treatment technology listed by EPA. EPA estimated that operating this water treatment system would reduce the operator's income by approximately 13%, so BLM reduced the number of mines that would operate by that same percentage. Alternative C, with water quality standards of zero ml/l settleable solids and zero NTU turbidity increase, would require operations comparable to the option 6c water treatment technology, including zero discharge, 100% recycle of process water, and flocculants. For this system, EPA estimated that the operator's income would be reduced by about 27%, so the number of mines was reduced by that percentage. The costs in Figure 2-6 are representative of a mine that processes 150,000 cubic yards per mining season.

A worst-case scenario to describe a level of placer mining more intense than expected was analyzed to predict those possible cumulative environmental impacts. This scenario could occur if unforeseeable circumstances caused this high level of activity, such as the price of gold increasing to $2,000 per ounce. The summary of this analysis is presented in Figure 2-8 and the assumptions are listed in Appendix B-2.

Under any of the alternatives, there are key considerations which are:

- Unavoidable Adverse Impacts
- Short and Long-Term Impacts on Productivity of Resources
- Irreversible and Irretrievable Commitments of Resources.

4.1 Geology and Topography

The scale of surface disturbance attendant to placer mining and related activities is quite small relative to that of natural topographic features as generally perceived. Further, such disturbances would be confined principally to redistribution of unconsolidated/semi-consolidated surficial geologic materials, which should generally be amenable to subsequent reclamation. Appreciable portions of streams and riparian areas are subject to short-term disturbance, frequently rather intensive in character, but long-term impacts are subject to prevention/amelioration via responsible, substantive reclamation efforts.

Each alternative requires some reclamation, which should result in little net modification of the overall topography of areas which have undergone mining activities. There would be some short-term, quite local and small-scale landscape modification impacts during mining activities. These modifications should be subsequently reclaimed, and yield few or no significant long-term impacts. A principal objective of effective reclamation is to return the landscape to a condition similar to that which existed prior to mining activity disturbances. Thus, as reclamation standards become increasingly more stringent, from Alternative A to the Proposed Action and from Alternative B to C, effects on topography which involve stream channel and riparian disturbances would be increasingly minimized. There should be little likelihood of irreversible or irretrievable commitments of topographic resources, in the sense of appreciable or significant net landscape modification under any of these alternatives. The required reclamation, under any of the alternatives, could also result in reclamation of adjacent older disturbed areas as well (cf. DOI 1988).

4.1.1 Proposed Action

Approximately 1,840 acres of river benches and bottom grounds will be disturbed and 672 acres will be reclaimed within 10 years, with the remainder reclaimed at the end of the mine life. Therefore, no significant cumulative impacts on topography, given the required reclamation, are expected.

Direct effects may be significant during actual mining due to disturbance and redistribution of gravel, overburden, and related materials. Indirect effects related to this will be due principally to the possibility of increased erosion of these materials during and after such disturbance.

4.1.2 Alternative A

There may be discernible modifications of landscape aspect under this alternative, since the reclamation requirements are directed only to stabilization of disturbed areas; reconfiguration is not required. However, the scale of these alterations in aspect will be relatively small in the overall context of the topographic features in this area of appreciable natural relief. Past disturbances covers approximately 3,079 acres, projected disturbance over 10 years is 1,610 acres.

4.1.3 Alternative B

Impacts under Alternative B will be the same as the Proposed Action.

4.1.4 Alternative C

Impacts under Alternative C will be the same as the Proposed Action, except that 1,334 acres will be disturbed.

4.1.5 Alternative D

The cumulative impacts under Alternative D will be similar to the Proposed Action, except that no further federal mining-related disturbance will occur. Mines on State and private lands within the study area will not be affected by this management alternative, hence the impacts will be similar to, but significantly less, than for the situation under the Proposed Action, since that there would be no mining on public lands.

4.1.6 Special Considerations

Unavoidable Adverse Impacts

For all alternatives except A, there would be some minimal alteration of original site aspect, as adequate reclamation does not necessitate attempting to restore the site identically to the original configuration. During mining, the site aspect would be modified to some degree, dependent upon the particular situation; this might be obtrusive in some situations.

For Alternative A, the impacts would in general, be similar to those discussed under the Proposed Action. Reconfiguration, except as necessary to stabilize against erosion, would not be required as part of reclamation, thus some readily discernible resultant impacts to landscape aspect might result; these would be small-scale in terms of the overall topography in this region of appreciable relief, however.

For Alternative D, mining would continue on State and private lands, hence associated unavoidable adverse impacts would presumably continue, although at a significantly lower level of cumulative impacts to the watershed.

Short-Term Uses vs Long-Term Productivity of Resource

For all alternatives, except A and D, there would be some short- term modification of site aspect during mining, which would, however, not significantly impact the overall topographic setting of the affected area, since the required reclamation would include reconfiguration and stabilization.

For Alternative A, the situation would generally be similar to the discussion under the Proposed Action. However, reclamation would not require reconfiguration, except where necessary to stabilize against erosion, thus some of the more obtrusive short- term disturbances of landscape aspect may persist over a longer term after the cessation of mining.

For Alternative D, the situation would generally be similar to the discussion for the Proposed Action. However, cessation of all mining on public lands would end further short-term and long-term impingements upon topography, with the exception of those associated with the activities on State and private lands.

Irreversible and Irretrievable Commitments of Resources

For all alternatives except A and D, there would be no significant irreversible and irretrievable commitments, since the required reclamation would be directed to reconfiguration and stabilization of the disturbed areas.

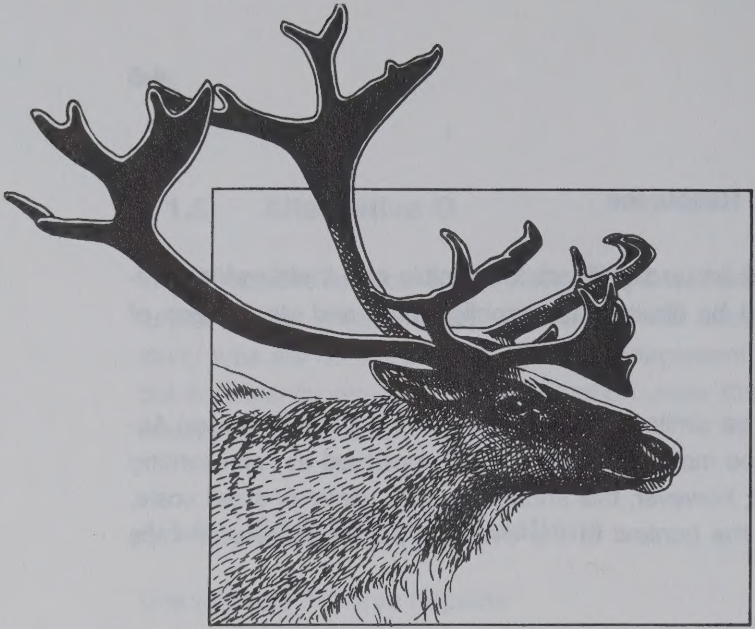
For Alternative A, the situation would generally be similar to the discussion under the Proposed Action. The possible persistence of some landscape modifications might be construed as representing a commitment, in terms of changed site aspect; however, this should be on a relatively small scale, and be relatively unobtrusive, when viewed in the context of the overall topographic relationships within this region of appreciable relief.

For Alternative D, the situation would generally be similar to the discussion for the Proposed Action. Cessation of all mining on public lands would end any further resource commitments with the exception of those associated with the activities on State and private lands.

4.2 Mineral Resources

BLM roughly estimates that the net present value of placer gold occurring in existing claims in the Birch Creek drainage study area is between 16.2 and 452.3 million dollars (Appendix B-3). The Alternatives become successively somewhat more restrictive to mineral resource development activities, from A to the Proposed Action and B through C, while D precludes mining on public lands in the study area. Thus, the short-term impacts, successively, are likely to be increased costs and inhibited further development of known mineral deposits because of the severity of such restrictions. For the short-term, most operations likely will try to meet these conditions; their success will vary, and depend on complex physical and economic factors, unique to each location, deposit, and operator. In the long term, there could well be a reduction in the number of operations, the size and scale of which will need modification.

"Commitment" of resources can be construed in one of two ways, somewhat simplistically, with regard to mineral resources. One view is that resources not developed, remaining in the earth, represent a "savings account" for possible future use. There is no irreversible-irretrievable commitment of mineral resources from this perspective; they merely remain unused and undiscovered, subject to future events. This view is frequently advocated with the avowed intent of preserving valuable resources for future, presumably more pressing, societal needs, including dire emergencies. However, there is inevitably appreciable time and effort required to obtain a product useful to society from even the known deposits (let alone undiscovered resources) of mineral raw materials in the earth, thus this interpretation of preservation for future urgent needs is not totally consistent with physical reality. Further, inhibition of mineral resource development in an area inexorably carries with it the corollary inhibition of exploration for extensions of known deposits and/or new deposits. This, in another sense, represents "irreversible and irretrievable commitment" of undiscovered resources, via ignorance of their existence, to a limbo of non-use by humanity.


Caribou

Alternatively, development of mineral resources entails, obviously, physical removal from the earth, and "commitment" to other uses - presumably of benefit to human society, both physically as well as economically. The minerals themselves are thus consigned, irreversibly and irretrievably, to human use, including repeated recycling in many instances.

Thus, as restrictions on development of the mineral resources increase, from Alternative A to the Proposed Action through D, the likelihood of "commitment" of the resources, in the first sense as used above increases; conversely, of course, the likelihood of "commitment" in the second sense as used above decreases, similarly. "Commitment of mineral resources" is used in this EIS in the second sense, (i.e., development), hence Alternative A would be most likely to be accompanied by maximum commitment, the Proposed Action, and Alternatives B and C successively less, and no commitment (for public lands) under Alternative D.

4.2.1 Proposed Action

There are no significant impacts on mineral resource availability for development.

4.2.2 Alternative A

Impacts will be the same as the Proposed Action.

4.2.3 Alternative B

Impacts will be the same as the Proposed Action.

4.2.4 Alternative C

Impacts will be the same as the Proposed Action.

4.2.5 Alternative D

Under Alternative D mining activity resource development and use would end on public lands within the study area. There would be severe negative impacts on exploration, extension, and development of known and unknown resources in the area and region.

Under Alternative D there would be the direct effect of cessation of mining activities, on public lands, as well as related exploration and development on public lands within the study area, plus the indirect negative effect on exploration and development elsewhere in Alaska as well. Known and undiscovered resources which otherwise might have been of value to society would be unused.

4.2.6 Special Considerations

Unavoidable Adverse Impacts

There are no significant impacts under the Proposed Action or Alternatives A, B, and C; Alternative D calls for a total cessation of mining and related activities on the public lands in the study area.

Short-Term Uses vs Long-Term Productivity of Resource

For all alternatives except D, short-term production of non- renewable resources necessarily implies decreased productivity at some future time. However, without development and use, mineral resources are "resources" only in a somewhat hypothetical sense. In the case of Alternative D, both short-term uses and long-term productivity will effectively be precluded on public lands.

Irreversible and Irretrievable Commitment of Resources

Mineral resources developed and produced represent irreversible and irretrievable commitments to human use. The resources may be recyclable, but are ultimately non-renewable, in terms of human use. This will be the case for all alternatives except the public lands in the study area, under Alternative D.

For Alternative D, such mineral resources as may be present on the public lands would be consigned, irreversibly and irretrievably, to a limbo of no development of known resources and ignorance of the existence of presently undiscovered resources. This would be subject, presumably, to possible subsequent changes in law under future circumstances.

4.3 Soils

The initial direct impact to soils from placer mining is the same under all alternatives, the differences lying in the extent of ground disturbed and the measures taken to promote recovery. Generally, placer mining completely destroys the structure of the existing soil profile through the stripping of overburden and processing of pay gravels. The usual procedure is for the overburden (including organic materials) to be stripped, coarse underlying materials separated from gold-bearing material in the processing plant, and fine materials treated or discharged with the wastewater stream. Three categories of wastes are produced as distinct units: overburden moved to the perimeter of the area of operation, larger rock and soil material deposited as tailings, and fine material collected in settling ponds or discharged with the wastewater stream. Under natural processes recovery from such disturbance occurs gradually over what may be a considerable period. Sidecast overburden begins to recover immediately. Revegetation of undisturbed fine sediments in settling ponds may begin as soon as the ponds are drained. Washed tailing piles, however, differ because they lack fine materials to trap moisture, so revegetation of these features is a very slow process. Initial growth occurs near waterline or where fine materials remain at or near the surface as a result of incomplete processing. Vegetative cover develops gradually in depressions or on the tops of the piles where wind or water-borne fine materials or organics accumulate, or where weathering is sufficient to degrade the coarser materials. Soil development and revegetation of more resistant or exposed areas of the tailings may require decades. The vegetation which occurs in such disturbed areas is typical of that which occurs in well-drained, warmer soils.

All alternatives discussed will result in long-term unavoidable impacts to the soil resources in the areas disturbed by mining. The rate of recovery will differ depending on conditions at any given site. The total expected disturbance under any of the alternatives is less than 0.16% of the drainage area. It is not known what percentage of a particular soil type within the basin will be affected. However, significant changes to the soil resources of the Birch Creek basin are not expected to occur.

4.3.1 Proposed Action

Approximately 1,840 acres would be disturbed by 1998, with approximately 60% of the disturbance (1,104 acres) attributable to federal mining operations. Reclamation would occur on 672 acres. The soil profile would be completely altered on all these disturbed areas. Disturbance of the soil profile and/or compaction of soils on an additional 221 miles of road and 59.3 miles of trail is anticipated. All federal operators would be required to stabilize the site and the stream channel. Operators on State or private claims would not be required to perform this reclamation. As a result federal claims should show reduced rates of erosion but would not generally show the initiation of a productive soil profile for approximately 50 years. Locations devoid of fine material would develop extremely slowly if at all with little or no vegetation being established in the near future. Areas containing fine material would develop a productive vegetative cover rapidly, but would be subject to high rates of erosion until a successional plant community is established. Approximately 736 acres would not be subject to this reclamation requirement. Areas not stabilized would continue to erode. The development of productive soils and reestablishment of vegetation would be retarded in these areas.

There is no possible way to mitigate the disturbance of the soil profile if placer mining takes place under current practices. The only measures that can be taken are the differing reclamation practices addressed in the alternatives. Under the current alternative, overburden would be stockpiled and backscattered. This would shorten the recovery period to the point of reestablishment of soils and vegetation. Mitigation to roads and trails could include requiring all access to occur during conditions of frozen ground and adequate snow cover, proper location of access routes, minimizing the amount of vegetation and soils disrupted, channel crossing provisions as appropriate, and runoff control on barren road and trail surfaces.

4.3.2 Alternative A

The physical impacts to soils under this alternative are identical to the Proposed Action. The only difference lies in the area of disturbance anticipated. A reduction from 1,840 acres to 1,610 acres of disturbance and from 672 to 588 acres of reclamation will not make a significant difference to the soils resource on a watershed-wide basis. The reclamation practices used on the federal claims will aid in stabilization of remaining soils and re-establishment of vegetation (see Landcover Chapter 4.5).

See discussion of mitigation under the Proposed Action. Stockpiling and respreading overburden would not be required under this alternative. Recovery of soils and vegetation would occur more slowly on areas where such reclamation did not occur.

4.3.3 Alternative B

The initial physical impacts to soils would be the same as in Alternative A, with 1,610 acres of disturbance and 588 acres of reclamation, 192 miles of road and 51 miles of trail. The different reclamation practices would determine the eventual impact on soils. All federal operators would be required to stabilize the stream channel, recontour and distribute the fine material, and respread the overburden. Operators on State and private claims would not be subject to this reclamation requirement. This would result in lower rates of erosion on the approximately 966 acres of federal ground by providing some protection to the soil material. The redistribution of fine material should reduce the possibility of large quantities of sediment entering the stream system, and would provide for a more uniform development of soil structure over the entire area of disturbance. Additionally, respreading of the organic overburden would promote the development of vegetative cover by providing micro-relief to trap moisture, particulates, and seeds. Slope angles would approximate the original contour. The approximately 644 acres of disturbance on non-federal mining operations would recover at rates depending on the condition under which they are left. Generally, it is anticipated that development of productive soils and invasion by vegetation would be slower on areas not reclaimed to the standards required of the federal operations. There would also be the potential for accelerated erosion of the unstable fines.

Fireweed

See discussion of mitigation under the Proposed Action. Scattering of fines from settling ponds should enhance recovery.

4.3.4 Alternative C

This alternative essentially provides for restoration of the disturbed areas by all operators in the watershed. The stream channel would be restored, disturbed areas would be recontoured with the fine material redistributed, and vegetation would be reestablished on the site. This would provide for a relatively rapid development of productive soils and reduce the potential for non-point source pollution (erosion and sedimentation) to minimal levels. Mitigation is the same as under the Proposed Action.

4.3.5 Alternative D

All areas disturbed after 1980 on federal mining operations would be stabilized and no new disturbance would occur on federal mining claims. This would result in impacts similar to the Proposed Action except there would be no further disturbance on approximately one-half of the mining claims in the watershed. Mining would probably continue on the State and private claims in the area, resulting in approximately 736 acres of disturbance by 1998. Federal claim areas would generally not exhibit accelerated erosion and should provide for the development of productive soils in reclaimed areas where fine material is available in approximately 30 years. Soil development would be retarded in those areas where fine sediments are unavailable, as identified in the foregoing discussion. There are no mitigating measures for soil resources which would be implemented under this alternative.

4.3.6 Special Considerations

Unavoidable Adverse Impacts

Under the Proposed Action the soil profile would be completely altered on approximately 1,840 acres of ground by mining operations. Soil resources would be impacted by access on approximately 280 miles of roads and trails through disturbance of the soil profile and compaction. Soil loss would necessarily occur on areas of surface disturbance, but this would be minimized by the requirement to save and stabilize overburden. Sidecast materials would temporarily alter the surface response to precipitation, as well as local relief.

Under Alternative A the soil profile would be completely altered on approximately 1,610 acres of ground by mining operations. Soil conditions may be impacted by access roads and trails through disturbance of the soil profile or by compaction. Soil loss would occur in areas of surface disturbance.

Under Alternative B the soil profile would be completely altered on approximately 1,610 acres of ground by mining operations. Soil resources would be impacted by access on approximately 243 miles of roads and trails through disturbance of the soil profile or compaction. Increased soil loss will necessarily occur on areas of surface disturbance, but this will be minimized by the requirement to save and stabilize overburden. Sidecast materials will temporarily alter the surface response to precipitation events, as well as local relief.

The soil profile under Alternative C would be completely altered by mining operations on approximately 1,334 acres of ground. Soil conditions may be impacted by access roads and trails through disturbance of the soil profile or by compaction. Increased soil loss would occur on all areas of surface disturbance until restabilization occurs. Sidecast materials would temporarily alter the surface response to precipitation, as well as local relief.

Under Alternative D the soil profile would be completely altered on approximately 736 acres of ground by mining operations on state or private claims. Soil conditions may be impacted by access roads and trails through disturbance of the soil profile or by compaction. Increased soil loss would occur on areas of surface disturbance.

Irreversible and Irretrievable Commitment

The irretrievable commitment of soil resources on mining claims affected under the Proposed Action and Alternatives A, B, and C would include those soils moved off-site by erosion. Soil profiles would be completely disrupted in the areas affected.

Under Alternative D, depending on the reclamation practices used on the State and private ground, reestablishment of a productive soil base could take 50 years or more. There would be no irreversible or irretrievable commitment of soil resources on federal claims.

Short-Term Use vs Long-Term Productivity

Under the Proposed Action and Alternative C the disturbance of the soil profile for placer gold recovery would result in the temporary loss of vegetative production and lack of availability of the disturbed areas to potential users such as wildlife. The redevelopment of soils may result in increased species diversity over the long term (see Chapter 4.5, Landcover). Under the Proposed Action research indicates the initiation of a productive soil base within 50 years if reclamation practices are adhered to. Restoration of existing soils may require centuries.

Under Alternative A recovery of soils would be protracted in areas where overburden is not stockpiled and respread.

Under Alternative C a productive soil base would eventually develop in 25-30 years if reclamation practices are adhered to.

There would be no additional effect to soil productivity as a result of mining operations under Alternative D. Short-term use on federal claims would be limited to reclamation activities. Activities on other claims in the area (approximately 40% of the current mining activity) would be unaffected. Access to the streams draining directly into the Wild portion of Birch Creek would cease. Recovery of soil resources on federal claims would be underway within a period of 30 to 50 years.

4.4 Water Resources

To conduct an impact assessment of differing alternatives without having a distinct project to focus on, projections must be made concerning the level of activity anticipated and the success of implementation of the alternative. The projections made for this analysis are found in Figures 2-2, 2-3, 2-4. At the same time different alternatives are derived from possible State and Environmental Protection Agency standards. This section, therefore, will evaluate other agency standards.

The primary impact to water quality to be expected from placer mining operations in the basin is an increase in sedimentation. An evaluation of sediment input from various sources, based on a methodology developed by the EPA (1973) is presented in Figure 4- 1. The tonnage figure for forested lands has been used to minimize the contribution from natural sources. This in turn tends to emphasize the contribution from areas affected by surface disturbances. This estimate is verified by comparison with regional analysis of sedimentation presented by Selkregg (1974).

The nature of the basin, its geology, and the relative size of the affected drainages are such that one would not expect a significant change in the chemical components such as heavy metals or ions, or biological constituents such as *Ghiardia* or coliforms. Similarly, the percentage of stream channel and bench disturbance would not lead one to expect a significant change in runoff characteristics such as response to storms, peak flows, or annual yield.

Projected Annual Tonnage Rates for Sediment in 1998[1]

Category	Proposed Action	Alternative A	Alternative B	Alternative C	Alternative D
Forest	46,224	46,224	46,224	46,224	46,224
Abandoned Surface Mines[2]	11,546	11,546	11,546	11,546	11,546
Active Federal Surface Mines[3]	94,050	81,825	81,825	68,625	0
Active State Surface Mines[3]	68,550	59,625	59,625	50,025	68,550
Construction[4]	150,092	134,949	134,949	118,607	111,347

[1] Calculated using estimates prepared in Figure 3-1.

[2] Assumed that no regrowth and regeneration occur (worst case).

[3] Assumes disturbances continue past 1998, but total reclamation at end of mine life.

[4] Construction of roads and other disturbances will contribute less sediment on successive years - but is not calculated here - includes the Steese Highway.

Figure 4-1. Comparison under the alternatives of projected 1998 annual tonnage rates for sediment for various categories in Birch Creek.

Considering the types and amounts of hazardous materials used by small placer mining operations, the lack of long-term storage of large quantities, and the lack of any history of significant spills requiring clean-up or mitigation, it is not anticipated that there will be a significant cumulative impact to the environment under any of the alternatives. Implementation of the waste treatment and disposal regulations will make such impact even less likely in the future.

Cumulative impacts to water resources from mining activities in the Birch Creek drainage will continue to occur under all of the alternatives evaluated. This is in part due to the presence of mining operations in the basin which are not on federal claims, as well as current basin conditions. State mitigation and reclamation requirements are less restrictive than those applied to federal claims. With the exception of impacts to surface waters, mitigation and reclamation on private claims is at the discretion of the owner. Implementation of the regulations for discharge of dredge and fill materials to wetlands and navigable water bodies of the United States is being initiated by the Army Corps of Engineers. The revised EPA water quality criteria for placer mining will be final later this year (1988). The impact of these actions on current methods of operation remains to be seen; however, more stringent discharge requirements are evaluated under several alternatives.

The impact on chemical water quality due to placer mining is unknown, but the AHC (1988) study on Birch Creek concludes that although data are limited, of those parameters tested arsenic, copper, lead, mercury, and manganese were found to exceed water quality standards. With the exception of arsenic, all of these elements can exceed standards under natural circumstances. Copper, iron, and manganese were found to exceed water quality criteria at Birch Creek Village. The study was unable to pinpoint the specific impacts of placer mining on Birch Creek.

Because placer mining is generally a non-consumptive use of water, there would be no significant impact on the overall water quantity of Birch Creek under any of the alternatives. Localized decreases in water quantity will occur between the intake and outfall at each operation. Other changes may occur through cementation of the streambed with sediment as discussed in Chapter Three. This effect is not possible to quantify with existing data. No assessment of the effects of disturbances resulting from placer mining impacts on stream response to storms was located in the literature reviewed. Response time would be decreased by such factors as shortening the length of the channel, increasing total surface water by creating tailings ponds, reducing channel roughness by sedimentation, and increasing percolation by removing fines in terrestrial substrates. Response time would be increased by such factors as an increased active layer resulting from the thawing of the soils and removal of impermeable clay strata, and diversion and retention of surface flows in process water treatment systems.

4.4.1 Proposed Action

Channel morphology will be directly affected in all areas where mining activities occur in the active channel. From the estimates presented in Figure 4-1, there could be approximately 12 miles of channel affected on federal claims and eight miles of channel affected on State and private claims. Generally, mining practices tend to reduce the sinuosity of channels and increase channel gradient. This will create an area of channel degradation at the upper end of the disturbance and an area of channel aggradation below. Water quality is affected during this process through the introduction of organic and inorganic constituents to the water column. This can result in both short and long-term impacts.

Under the Proposed Action water quality would probably be worse than the conditions that existed during the 1987 mining season due to the projected increase in the number of operations. Mining operations would meet the settleable solids standard most of the time, but the turbidity standard would not be met without modifications to current operating procedures. Retention of settleable solids on-site will help minimize cementation of the stream bed and the resulting aggradation of the stream channel, isolation of surface and ground water, and changes in channel morphology. It is likely that occasional high water or failure of water control structures would introduce sediments to the stream channel collected by the water treatment systems. The degree of impact from such occurrences would depend on the amount of material released from the site and the streamflow at the time of release. Releases resulting from high flows should be less persistent than those resulting from other causes. Increased levels of turbidity would occur on all actively mined streams, reducing the penetration of light into the water column, thus impacting primary productivity. Turbidity would probably be detectable far downstream on Birch Creek for the entire mining season.

Indirect impacts on water quality would occur through accelerated erosion from areas disturbed until the site is fully revegetated. Channel cutting and resuspension of particulates would also occur until the stream reaches equilibrium. These processes would introduce sediment to the water column, particularly during spring breakup and floods. By requiring federal operators to stabilize their operations site, there should be a reduction in the amount of erosion, and the corresponding sedimentation and turbidity introduced, from these non-point sources. Because the federal operations represent only a portion of the total number of operations in the watershed, and similar requirements would not be in effect on State and private claims, it is likely that current impacts to water quality would continue at a somewhat reduced level. These impacts could be expected to decrease after cessation of all mining until successful revegetation of the disturbed areas and flushing and stabilization of the channel has occurred. It is projected that revegetation would take 30 years on federal claims, and 50 years or more where such reclamation does not occur (see Landcover, Section 4.5). Channel stabilization and flushing of the stream bed would be dependent on the occurrence of a low-period flood (25 years or greater). In the smaller tributaries natural restitution may never occur.

There would be no detectable changes in channel morphology due to possible increased sedimentation from active mining downstream in Birch Creek if the standards for settleable solids are met. Standards for settleable solids are expected to be met most of the time while compliance with the turbidity standard would not be achieved due to variances authorized by the regulatory agencies.

The quantity of sediment moved due to natural causes or mining within or through the system by Birch Creek is not definable with the current data. For comparative purposes, under the Proposed Action, BLM estimates that the soil loss from the Birch Creek watershed from natural erosion and non-point sources would be approximately 1,852 tons per day based on a 200-day open water season (Figure 4-1). This estimate is consistent with that derived from Selkregg (1974).

The impact of placer mining from federal non-point sources undoubtedly results in some contribution to the sediment load of the stream system. However this analysis indicates that, with the possible exception of surface flow from large storms, the downstream effect from non-point sources under the Proposed Action would be indistinguishable from expected natural conditions.

There is no information in the current literature on the production of sediments from roads and trails in the basin. The primary sources of sediment production would be stream crossings, roadways directly adjacent to stream channels, and improved roads and trails which converge down-gradient to stream channels and lack runoff control or sediment traps. It is anticipated that the majority of the erosion from road surfaces would be quickly intercepted and contained by the surrounding vegetation.

Conclusions

Meaningful predictions of impacts from turbidity and the sedimentation of the streambed are not possible. However, this analysis indicates that the discharge of effluent from active, operating mines is the major contributor to water quality deterioration in the watershed. If water quality standards are enforced as they have been in recent years there will continue to be a deterioration in water quality, particularly in increased turbidity, over the period of this analysis due to the projected increase in the number of mining operations. Elevated levels of certain chemical constituents can be expected as discussed in Chapter Three. The contribution of sediment from the non-point sources is unknown and cannot be adequately quantified with the existing data.

4.4.2 Alternative A

Qualitative impacts to water resources under this alternative will essentially be the same as those addressed under the Proposed Action. The primary difference would be the emphasis on achieving compliance with the turbidity standard. Reducing the requirement for reclamation may result in increased input of sediments from disturbed areas until a protective vegetative mat is reestablished. However such input should be largely restricted to nonpoint discharge resulting from storms.

The estimates in the Birch Creek worksheet indicate that approximately 10.5 miles of channel on federal claims and seven miles of channel on State and private claims will be affected. This slight decrease in impact over that of the Proposed Action results from the expectation of a decrease in activity due to more stringent water quality requirements.

Under this alternative there may be a slight improvement in the direct impacts to water quality over the 1987 season. All operators would be required to meet the water quality standards. The settleable solids standard would be met most of the time and there would be a reduction in the sediment load of Birch Creek. There should be a resultant decrease in turbidity as well. Levels of turbidity are not predictable with existing data. Further, it is not clear how the standards would be enforced. If all operators were allowed to discharge at five NTU above background, gross discharge would be 350 NTU.

Increased use of flocculents in the treatment of process waters may have an impact on water quality as discussed in Chapter Three, unless such chemicals (and their decomposition products) are required to be biologically inactive. Overcharge of flocculents in treatment systems and discharge into streams may in fact result in removal of sediments which might otherwise be carried through the stream system.

For comparative purposes, under this alternative BLM estimates that the soil loss from the Birch Creek watershed from natural erosion and disturbed sources would be approximately 1,852 tons per day based on a 200-day open water season. This approximation is consistent with figures derived from Selkregg (1974). Contributions from specific sources are presented in Figure 4-1.

Conclusions

Under this alternative the TSS and turbidity entering the mainstem of Birch Creek would be reduced. Water quality standards would generally be met by all operations, with violations limited to uncontrolled discharges resulting from accidents or storms. Achieving such results would require substantial changes in current methods of operation, such as use of flocculents and recycling of process waters. It is not known what effect reduced TSS and turbidity would have on those recoverable constituents which currently exceed the water quality standards; however, it is expected that they would be reduced as well.

4.4.3 Alternative B

Because the management of effluent discharge and projections of the mining activity are the same as in Alternative A, direct impacts to water quality under this alternative would be identical to those discussed in Alternative A.

The effects on channel morphology from the implementation of this alternative would be similar to those presented under Alternative A. The additional mitigation and reclamation required should reduce the input of sediment to the stream, and thus the sediment load. Given the existing situation, such a reduction is not expected to have a significant impact on the forces required to achieve reestablishment of a natural channel.

The indirect impact on water quality would be temporally less than under the previous alternative due to the reclamation practices reducing the time for establishment of stable banks and vegetative cover. Estimates of the time required for revegetation of the disturbed area are 30 to 50 years (see Landcover, Section 4.5).

The impacts on chemical water quality under this alternative are identical to those discussed under Alternative A, with the potential for a slight reduction in mineral and organic input.

Impacts from roads and trails in the area would be as discussed under Alternative A. Soil loss would also be the same as under Alternative A.

Conclusions

Under this alternative the overall TSS entering the mainstem of Birch Creek would be reduced. The major contribution to sediment loads of Birch Creek from mining would likely be due to operations on State and private ground. With large State and private operations on Eagle, Mammoth, and Crooked Creeks the water quality of these tributaries would probably still be degraded by non-point discharge. Creeks with significant numbers of federal operations would show improved water quality.

4.4.4 Alternative C

Some direct effects on water quality can be anticipated during the development stage of an operation due to the construction of settling ponds and stream bypasses and through rechannelization of the stream if required. This would result in short-term increases in sediment levels and turbidity while equipment operates in the active stream channel, and during the period required for stabilization. During the production phase of operations, if "zero discharge" was truly attained, there would be no direct impact on water quality from mining operations. However, it is likely that occasional high water or failure of water control structures would introduce sediments collected by the water treatment system to the stream channel. This would create short-term increases in turbidity and TSS levels and possible localized sedimentation of the stream substrate. The degree of impact would depend on the amount of material released from the site and the streamflow at the time of release. Restoration of the stream channel would occur on federal claims. This would reduce the period of time required for channel recovery in those areas affected.

Indirect impacts on water quality would occur through accelerated erosion from disturbed areas. Production of sediment from the channel would also occur until the stream reaches equilibrium. These processes would introduce sediment to the stream system, particularly during spring breakup and floods, until successful stabilization and revegetation occurs (see Landcover, Section 4.5). Impact from federal operations would largely be limited to non-point source discharge from storms.

For comparative purposes, under this alternative BLM estimates that the soil loss from the Birch Creek watershed from natural erosion and non-point sources would be approximately 1,475 tons per day based on a 200-day open water season (Figure 4-1). This is consistent with figures derived from Selkregg (1974). Approximately 8.8 miles of stream channel on federal claims and 5.8 miles of stream channel on State claims and private mines will be affected by mining operations.

The impact on chemical water quality would be identical to that discussed under Alternative A. The additional mitigation and reclamation required should result in a decrease in the contribution of mineral and organic constituents from operations on federal claims. It is not currently possible to quantify the impact on water resources downstream with the data available.

Conclusions

Under this alternative the overall TSS and turbidity entering the mainstem of Birch Creek would be considerably reduced. The effect on downstream uses on Birch Creek is unknown, but is expected to be minimal due to the large amount of dilution. The primary source of sediment input would be from non-point sources on unstabilized ground or uncontrolled discharges from processing systems. The impact on chemical constituents is unknown.

4.4.5 Alternative D

Because placer mining is generally a non-consumptive use of water, there would be no significant impact on the overall water quantity of Birch Creek under this alternative. Very localized changes in water quantity could occur through cementation of the streambed with sediment as discussed in Chapter Three. This effect is not possible to quantify with existing data.

As mining continues at levels comparable to the 1987 season, water quality in Birch Creek would continue to show elevated levels of TSS and turbidity even without the contribution from federal operations. Major contributors would probably be from Eagle, Mammoth, and Crooked Creeks, where large tracts of State and private ground exist. Although water quality in Birch Creek would probably show decreased levels of TSS, the State standards would still probably not be met.

Indirect impacts on water quality would occur through accelerated erosion from areas disturbed until the site is fully revegetated. This could take at least 50 years on unreclaimed sites. Channel cutting would also occur until the stream reaches equilibrium. These processes would introduce sediment to the stream system, particularly during the spring breakup and during floods. The degree of impact would not be significant enough to be easily detectable downstream on Birch Creek.

For comparative purposes, under this alternative BLM estimates that the soil loss from the Birch Creek watershed from natural erosion and non-point sources would be approximately 1,188 tons per day based on a 200-day open water season (Figure 4-1. This agrees with the figures derived from Selkregg (1974).

Conclusions

Under this alternative the overall TSS entering the mainstem of Birch Creek would be reduced. The major contribution to the increased sediment loads of Birch Creek would likely be due to operations on State and private ground. With large State and private operations on Eagle, Mammoth, and Crooked Creeks the water quality of these tributaries would probably still be degraded, particularly during storms. Creeks with significant numbers of federal claims would show improved water quality.

4.4.6 Special Considerations

Unavoidable Adverse Impacts

Unavoidable adverse impacts are short to long-term increases in suspended sediment and turbidity, accelerated erosion from disturbed areas resulting in a secondary increase in sediment introduced to the stream system, and changes in channel morphology in the vicinity of the disturbed area. With the exception of sediments that have cemented the stream channel and been deposited in depositional zones, sediments discharged are flushed by annual break-up or floods. Deposition in the downstream areas would continue until such materials are moved through the system by a major event. There will also be an increase in some mineral and organic constituents, and localized reductions in flow between intake and outfall. Lacking a significant flood, isolation of the surface and subsurface flows is expected to continue. There are insufficient data to assess the likelihood of recementing should such a flood occur. Such factors will affect the productivity, potability, and aesthetics of water resources downstream from placer mining in the Birch Creek basin.

Irreversible and Irretrievable Commitment

As identified above, it is not known whether or when or to what extent the stream channel will recover from existing impacts. Although there is no verification, it has been reported that there has been some sedimentation of sloughs and lakes in the lower reaches of the stream. If this is the case, such a condition would probably be permanent. Water quantity is not likely to be significantly affected, and water quality would return to approximately natural conditions after successful stabilization of the disturbed area and stream channel. However, this may take considerable time.

Short Term Use vs. Long Term Productivity

The long-term productivity of the stream will be affected by placer operations until stability and equilibrium are reestablished. Channel shortening will remain after cessation of mining until the occurrence of a low-period flood. Cementation of the streambed and isolation of the surface and subsurface waters would continue until the occurrence of a major event as well. Sediment deposition will gradually decline until stabilization of stream banks and reestablishment of the stream channel occurs. Impacts on water resource values downstream on Birch Creek are unknown.

4.5 Landcover

Analysis of acreages affected by mining and reclamation is based on projected disturbance for mining and associated claim access roads and trails (Appendix D-1). Estimates of acreages for all alternatives are in Figure 4-2.

The major variation among alternatives which will affect landcover is the relative amount of fine materials remixed in the tailings during reclamation. This fine material content affects both the rate of regrowth and the acreage which will recover to a stable productive vegetative community.

		Acres disturbed from mining	Acres disturbed from roads	Acres disturbed from trails	Acres reclaimed	% barren after regrowth on reclaimed land	% barren after regrowth on unreclaimed land	Acres barren after regrowth	Acres barren from all mining & roads	Acres of successional community on old mined tailings	Acres of successional community on new ground
Pre – 81		3,079	353	240			85%	2,617		461	
1987	Federal (old)					85%	85%	93		16	
	Federal (new)					75%	75%	82			27
	Total federal	220	353	240	75			175			
	State (old)					85%	85%	157		28	
	State (new)					75%	75%	138			46
	Total state	370	94	0	25			295			
	Joint road		225	0							
	Total	590	672	240	100			470	3,760	505	73
Proposed Action	Federal (old)					85%	85%	469		83	
	Federal (new)					40%	75%	296			255
	Total federal	1,104	893	215	672			765			
	State (old)					85%	85%	312		55	
	State (new)					40%	75%	276			92
	Total state	736	131	0	0			589			
	Joint roads		315	0							
	Total 1998	1,840	1,339	215	672			1,354	5,310	599	347
Alternative A	Federal (old)					85%	85%	411		72	
	Federal (new)					75%	75%	362			121
	Total federal	966	777	187	588			773			
	State (old)					85%	85%	274		48	
	State (new)					75%	75%	241			80
	Total state	644	115	0	0			515			
	Joint roads		274	0							
	Total 1998	1,610	1,166	187	588			1,288	5,070	582	201

CONTINUATION

		Acres disturbed from mining	Acres disturbed from roads	Acres disturbed from trails	Acres reclaimed	% barren after regrowth on reclaimed land	% barren after regrowth on unreclaimed land	Acres barren after regrowth	Acres barren from all mining & roads	Acres of successional community on old mined tailings	Acres of successional community on new ground
Alternative B	Federal (old)					85%	85%	411		72	
	Federal (new)					40%	75%	259			224
	Total federal	966	777	187	588			670			
	State (old)					85%	85%	273		48	
	State (new)					40%	75%	242			80
	Total state	644	115	0	0			515			
	Joint roads		274	0							
	Total 1998	1,610	1,166	187	588			1,185	4,967	582	304
Alternative C	Federal (old)					50%	85%	256		146	
	Federal (new)					40%	75%	216			186
	Total federal	805	652	157	490			472			
	State (old)					50%	85%	168		96	
	State (new)					40%	75%	142			122
	Total state	529	96	0	322			310			
	Joint roads		230	0							
	Total 1998	1,334	978	157	812			782	4,377	704	308
Alternative D	Federal (old)					85%	85%	0		0	
	Federal (new)					40%	75%	0			0
	Total federal	0	353	240	0			0			
	State (old)					85%	85%	312		55	
	State (new)					40%	75%	276			92
	Total state	736	446	0	0			588			
	Joint roads		0	0							
	Total 1998	736	799	240	0			588	4,004	516	92

Figure 4 – 2. Acreage estimates for impacts of placer mining on landcover. Disturbance of "old" ground refers to previously mined, often dredged, areas. "New" ground is previously unmined, and revegetation estimates are based on sluicing operations. "State includes claims on state land and all private operations. Blank spaces indicate data not applicable or not available.

Figure 4-3 illustrates various rates of succession on substrates with different percentages of sub-sand-sized fine materials. Analysis of the impacts of the alternatives is therefore largely based on the differing regrowth rates resulting from different reclamation techniques and the mix of fine materials in the tailings.

Figure 4-3 was developed using data from studies and observations of regrowth on tailings (Rutherford & Meyer 1981, Holmes 1981, Halloran 1986, Spencer 1987). The four arrowed lines represent average time frames for succession to various vegetation communities. Most disturbed areas in the Birch Creek watershed will follow this or a similar pattern of native species regrowth. Cumulative effects become apparent when the disturbed area is large enough to influence seed dispersal into barren ground, or when repeated disturbances such as remining old tailings maintain one of the pioneering communities.

A stable, sustaining productive community is considered to be the open tall shrub community, shown on Figure 4-3. This is generally a tall willow and/or alder community with a canopy cover of at least 50% in vegetated areas, where dying vegetation is replaced by seed or vegetative means. Such a community can sustain moderate pressure from wildlife, especially beaver or browsing moose, and may continue on the site indefinitely, or be successional to a deciduous forest with mixed spruce.

Mining prior to 1981 has resulted in surface disturbance to approximately 3,100 acres in the Birch Creek watershed. Three hundred fifty acres are used for roads, and an additional 240 acres are used for trails.

4.5.1 Proposed Action

During 1987, a total of 590 acres were mined in the Birch Creek watershed on federal, State, and private mining claims. Claims on federal lands accounted for 220 acres, approximately half of this area on previously-mined tailings. Seventy-five acres were reclaimed on federal lands by reshaping tailings, and respreading topsoil where available from new mining ground. State and private operations covered 370 acres, with various levels of reclamation on 25 acres.

Regrowth to a stable sustaining shrub community on mined new ground will take approximately 30 years. Areas which are being mined on old tailings have little to no topsoil and overburden to spread over the reshaped tailings. The lack of fine materials in the reclaimed tailings will retard rapid regrowth of vegetation. Regrowth to a stable, sustaining productive community of tall shrubs will take approximately 50 years (Figure 4-3). Prior to that, this area will have low value for big game habitat, especially for use as winter moose browse (Section 4.6).

As future mining operations disturb new ground, topsoil and overburden may be available for respreading over the tailings. The length of time to grow to a stable, productive shrub community will be approximately 30 years for disturbance on new ground. Further disturbance on old tailings will take approximately 50 years for regrowth. The difference in regrowth rates is largely attributable to the higher proportion of fine- grained materials in tailings from mining new ground.

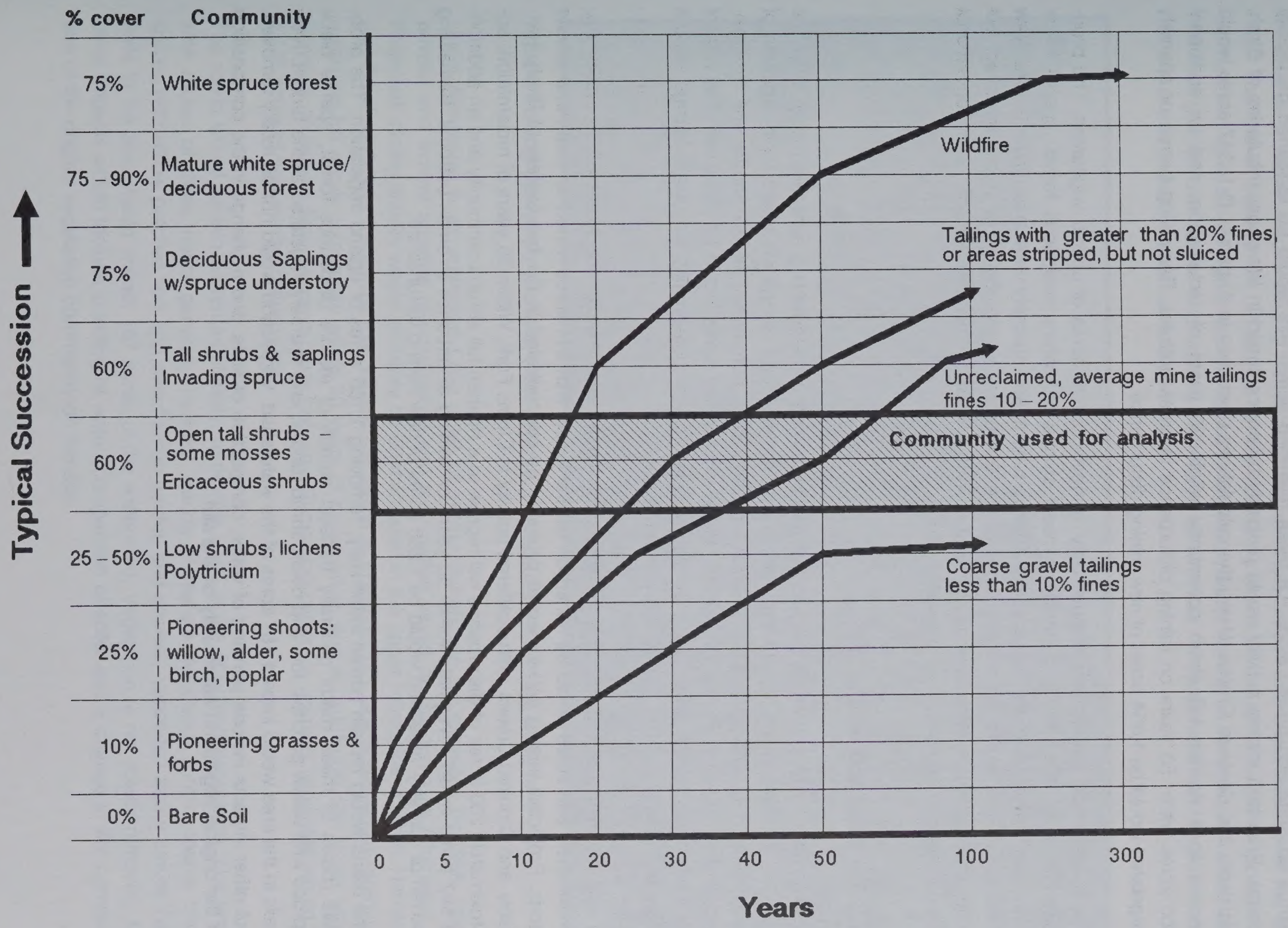


Figure 4 – 3. Comparison of succession rates after various reclamation approaches and natural wildfire.

Under the Proposed Action, 1,840 acres of additional mining disturbance are projected by 1998. Claims on federal lands are projected to disturb 1,104 acres, with an additional 736 acres of disturbance on State and private lands. Of these disturbed acres, 672 would be reclaimed on federal claims. Projected mining activity would probably be concentrated in the upper tributaries of Birch, Harrison, and Crooked Creeks. Using the calculations discussed in Appendix D-1, 347 acres would regrow to a riparian tall shrub community within 30 years of reclamation, and an additional 600 acres within 50 years on mining disturbance in creek bottoms. Remaining barren or sparsely vegetated would be 1,354 acres of new mining disturbance.

The roads would remain barren indefinitely, removing 1,339 acres of upland vegetation. The probable routes of these roads generally transect stands of mature deciduous forest, sparse black spruce with willow patches, low and dwarf shrub tundra, and sparsely vegetated alpine tundra. New trails in the area would impact 215 acres of the watershed. Vegetation is not totally removed, but other impacts would include ponding of water in low areas, compaction of soils, and vegetational changes in the disturbed areas along the sites.

4.5.2 Alternative A

Reclamation for this alternative would not require saving or respreading available topsoil over the tailings. The consequent lack of fine materials in the reclaimed tailings will retard rapid regrowth of vegetation. Regrowth to a stable, sustaining productive community of tall shrubs will take approximately 50 years (Figure 4-3). Under this alternative 588 acres would be reclaimed. The rate of regrowth on reclaimed areas would be similar to the rate on unreclaimed washplant tailings without respreading of stockpiled topsoil and overburden.

Under Alternative A, 1,610 acres of additional mining disturbance are expected by 1998. Approximately 966 acres would be mined on federal lands, with 644 acres mined on State and private lands. Projected mining activity would probably be concentrated in the headwaters of Birch, Harrison, and Crooked Creeks, with scattered activity in Clums Fork. Within 30 years of reclamation, approximately 200 acres of disturbance will regrow to a riparian tall shrub community and an additional 582 acres would revegetate within 50 years on mining disturbance in creek bottoms. Remaining barren or sparsely vegetated would be 1,288 acres of new mining disturbance.

The roads would remain barren indefinitely, removing 1,165 acres of upland vegetation. The probable routes of these roads generally transect stands of mature deciduous forest, sparse black spruce with willow patches, low and dwarf shrub tundra, and sparsely vegetated alpine tundra. New trails in the area would impact 187 acres of the watershed. Vegetation would not be totally removed, but other impacts include ponding of water, compaction of soils, and a change in the composition of the original vegetation community on the site.

4.5.3 Alternative B

Alternative B would require saving and respreading available topsoil and overburden over the tailings. The rate of regrowth on old tailings for this alternative would be the same as the Proposed Action for mining in old tailings (regrowth approximately 50 years). Mining on new ground would permit fine- grained overburden and organic material to be available for reclamation and regrowth to a tall shrub community in approximately 30 years.

Typical mining operation showing river tailings. Courtesy of Bureau of Land Managment.

Under Alternative B, an additional 1,610 acres of mining disturbance are expected by 1998. State, private, and federal acreage of disturbance and reclamation would be the same as Alternative A. Projected mining activity would probably be concentrated in the upper tributaries of Birch, Harrison, and Crooked Creeks. Using the calculations discussed in Appendix D-1, 304 acres would regrow to a riparian tall shrub community within 30 years of reclamation, and an additional 582 acres within 50 years on mining disturbance in creek bottoms. Remaining barren or sparsely vegetated would be 1,185 acres of new mining disturbance.

The roads would remain barren indefinitely, removing 1,165 acres of upland vegetation. The probable routes of these roads generally transect stands of mature deciduous forest, sparse black spruce with willow patches, low and dwarf shrub tundra, and sparsely vegetated alpine tundra. New trails in the area would impact 187 acres of the watershed. Vegetation is not totally removed, but other impacts would include ponding of water, compaction of soils, and a change in the composition of the original vegetation community on the site.

4.5.4 Alternative C

Alternative C would require that topsoil and overburden be saved and respread over reconfigured tailings. With the mining in old tailings, another source of fines is necessary to facilitate natural revegetation on the site. One possible source would be to use fines from the abandoned settling ponds. Further enhancement such as fertilization and seeding may be required by BLM in approving individual Plans of Operation. Neiland (1978) and Peterson and Peterson (1977) point out that fertilization and seeding with domestic species tends to encourage non-native species at the expense of invasion and establishment by native species. Both suggest a combination of techniques to facilitate vegetation quickly to reduce erosion, and to enhance eventual establishment of a community of native plants. Mowatt (DOI 1987d) outlines many mitigation techniques for preparing soils, and considerations for revegetation of tailings during reclamation. The details of this work would have to be site-specific, and specified in the individual Plans of Operation for the mine.

On sites where a variety of techniques are used, including mixing of settling pond fines in the tailings, fertilization, seeding, and mulching to enhance regrowth; a stable, sustaining community of tall shrubs will be established in approximately 25-30 years. Extent of permanent barren area will be reduced to approximately 50%.

Under Alternative C an additional 1,334 acres of mining disturbance are expected by 1998. Eight hundred five acres are projected for mining on federal lands, with 529 acres on State and private lands. Reclamation would occur on 490 acres of federal claims, and 322 acres of State and private lands. Projected mining activity would probably be concentrated in the upper tributaries of Birch, Harrison, and Crooked Creeks. Using the calculations discussed in Appendix D-1, 309 acres would regrow to a riparian tall shrub community within 25 years of reclamation, and an additional 704 acres would regrow within 50 years on mining disturbance in creek bottoms. Remaining barren or sparsely vegetated would be 782 acres of new mining disturbance.

The roads would remain barren indefinitely, removing 977 acres of upland vegetation. The probable routes of these roads generally transect stands of mature deciduous forest, sparse black spruce with willow patches, low and dwarf shrub tundra, and sparsely vegetated alpine tundra. New trails in the area would impact 157 acres of the watershed. Vegetation is not totally removed, but other impacts include ponding of water, compaction of soils, and a change in the composition of the original vegetation community on the site.

4.5.5 Alternative D

Under this alternative there would be no further mining on federal claims in the watershed. The rate of regrowth would be very similar to Alternative A, with the existing disturbance becoming revegetated by natural processes. Existing old tailings would not be reclaimed because there would be no further mining in those gravels. Future impacts listed below will come from mining on State claims and private lands; past impacts will carry over from historical mining on all lands.

Under Alternative D, no additional acreage of mining disturbance on federal lands is expected by 1998. Non-federal operations are projected to disturb an additional 736 acres, with no reclamation requirements. Regrowth by natural processes on new mining would take 40 to 50 years, depending on the location of the disturbed area. Regrowth to a tall shrub community from mining on new ground would total 92 acres. An additional 55 acres would regrow on old tailings in approximately 50 years. The roads would remain barren indefinitely, removing 798 acres of upland vegetation. Existing trails affect 289 acres. Vegetation is not totally removed on trails, but other impacts include ponding of water, compaction of soils, and a change in the composition of the original vegetation community on the site. A total of over 4,000 acres would remain barren or sparsely vegetated for a long period, including 2,617 acres of old tailings, 798 acres of roads, and 588 acres from new mining on non-federal lands.

4.5.6 Special Considerations

Irretrievable and Irreversible Commitments of Resource

Not all areas become revegetated, rather some remain barren or sparsely vegetated for long periods (over 90 years) after mining and reclamation activities are complete. The amount of ground remaining barren depends principally on the the proportion of fine-grained materials in the reclaimed tails, and on other site- specific factors. Under the Proposed Action, a total of 5,310 acres will be left barren. The barren area includes tailings from past mining (2,617 acres), new mining (1,354 acres), and all roads (1,339 acres). A certain amount of barren acreage will be an irretrievable and irreversible loss of vegetation resources under all the alternatives.

Under Alternative A, 5,070 acres would be left barren, including tailings from past mining (2,617 acres), new mining (1,288 acres), and all roads (1,165 acres).

Under Alternative B, a total of 4,967 acres would be left barren. This includes tailings from past mining (2,617 acres), new mining (1,185 acres), and all roads (1,165 acres).

Under Alternative C, a total of 4,377 acres would be left barren. This includes tailings from past mining (2,617 acres), new mining (783 acres), and all roads (977 acres).

Under Alternative D, a total of over 4,000 acres would be left barren. This includes tailings from past mining, new mining on State and private lands, and all roads. This barren acreage is an irretrievable and irreversible loss of vegetation resources.

Unavoidable Adverse Impacts

During mining operations, the vegetation cover is destroyed in the areas of the mine and roads, resulting in a short-term unavoidable loss of productivity. Under the Proposed Action there would be a long-term cumulative unavoidable loss of 5,310 acres of the vegetation cover of the area.

Under Alternative A there would be a long-term unavoidable loss of 5,070 acres of the vegetation cover of the area.

Under Alternative B there would be a long-term unavoidable loss of 4,967 acres of the vegetation cover of the area. There would also be an unavoidable loss of the original riparian community, which is replaced by an earlier successional community, and soils, including permafrost, for 100 to 200 years.

Under Alternative C there would be a long-term unavoidable loss of 4,377 acres of the vegetation cover of the area. There would also be an unavoidable loss of the original riparian community, which is replaced by an earlier successional community, and soils, including permafrost, for 100 to 200 years.

Under Alternative D there would be a long-term unavoidable loss of over 4,000 acres of the vegetation cover of the area. There also would be an unavoidable loss of the original riparian community, which is replaced by an earlier successional community, and soil structure, including permafrost, for 100 to 200 years.

Short-Term Use vs Long-Term Productivity of Resource

Most of the existing mining disturbance in the valley dates from 1910 to present. The area has regrown with a mosaic of barren and sparsely vegetated types, and tall shrubs. The sites which have regrown to a community of open tall shrubs of willow, birch, and balsam poplar have the same or higher productivity than that of the original riparian community on the site. This regrowth has taken approximately 50 to 70 years since mining disturbance (Figure 4-3). As succession proceeds further toward mature deciduous or white spruce forest, productivity will gradually decline.

4.5.7 Threatened and Endangered Plants

Within the Birch Creek drainage study area there are currently no "listed or candidate" threatened or endangered plant species. There are plant species considered by BLM to be "endemic," those being considered by the Fish and Wildlife Service for listing as threatened and endangered (Section 3.5.4). The existing surface management regulations, 43 CFR 3809.2-2(d), apply. Assessments of proposed development sites, which are required under all alternatives causing disturbance, help to eliminate impact upon threatened, endangered or endemic plants and their habitats. Therefore, the cumulative effects upon any endemic plant species would be similar for all alternatives.

BLM policy is to protect, conserve, and manage federally and State-listed threatened and endangered plant species and candidate plants, and to use existing BLM authority to further the purpose of the Endangered Species Act and similar state laws. The BLM will ensure that actions authorized, funded, or carried out will not jeopardize the continued existence of such species or result in the destruction or adverse modification of their critical habitats. Specifically, BLM will: 1) Evaluate information to determine the distribution, abundance, reasons for current status, and habitat needs for candidate species on BLM lands, and the significance of BLM lands and actions in maintaining those species. 2) Evaluate all information to determine whether it is adequate to make informed management decisions (BLM Manual, Section 6840). Priority is given to species for which significant adverse impacts are anticipated or for which there is a high risk in not knowing population trends. The effectiveness of the initial habitat assessment for the Proposed Action is vital to the survival and conservation of these species. These mitigation measures apply to all alternatives.

Unavoidable Adverse Impacts

Any disturbance or impact upon endemic species constitutes undue degradation. However, at this time the potential unavoidable loss of endemic plant habitat due to mining in Birch Creek watershed is unknown. It is beyond BLM's present capabilities to clear all proposed development sites of possible disturbance to endemic species because of incomplete site-specific studies.

Short-Term Uses vs Long-Term Productivity of Resources

It is difficult to evaluate Threatened, Endangered, or Endemic plant species for short or long-term productivity because once a species is disturbed it may well lead to extinction in that particular area. Because of the pre-action assessments there should be no short or long-term threats within the Birch Creek watershed. Overall, the best management practice in this case is avoidance of the resource.

Irreversible and Irretrievable Commitment of Resources

There are no irretrievable or irreversible conditions threatening the species involved.

4.6 Wildlife

The degree of impact to wildlife habitat and populations resulting from mining-related activities depends on the location, timing, and frequency or extent of the activity. The format adopted to analyze and discuss the impacts of the Proposed Action and alternatives on wildlife resources includes those factors common to all alternatives and those specific to the Proposed Action and each alternative.

Analysis Approach

For the purpose of this analysis, mineral development activities were broken down and categorized into components. The major action components used to assess the environmental consequences of the Proposed Action and Alternatives on wildlife resources were access, facilities, and operations (Figure 4-4).

In the analysis of the effects of access BLM considered the type of vehicle(s) involved, material(s) being transported, location and length of access route, and how often the route would be used in the present and future. Subcomponents considered under facilities include the number and size of

ACCESS	FACILITIES	OPERATIONS
Type(s) of vehicle(s) Materials transported Location & length of route Frequency of current route use Frequency of future route use	Number & size of structures Size of pad(s) Number, timing & duration of people present Type & amount of waste produced How often waste is disposed of	Type/amount of equipment Timing & duration of equipment operation Size of area stripped Size of area mined Size of various stockpiles Settling basin number & size Size of other surface disturbance

Figure 4-4. The three major components and subcomponents of mineral development used to assess impact on wildlife by the Proposed Action and the alternatives.

structures; the size of pad(s); the timing, frequency, and duration of human activity; the type and amount of waste produced; and the frequency of waste disposal. Distinct aspects of the operation component included the type and number of equipment used, timing and overall duration of equipment use, size of the area to be stripped, size of the area to be mined, size of various stockpiles, number and size of settling basins, and the size of any other surface disturbances. In this analysis BLM assumes that mitigation measures or guidelines for State and private mining activities are similar to those required for federal operations, except for reclamation (Section 2.3).

General Impacts

The general potential impacts from the access, facilities, and operation components on the wildlife resource are identified in Figure 4-5. The levels of impact attributable to federal, State, and private mining activities for the Proposed Action and alternatives were subsequently determined and are presented in detail in Sections 4.6.1-4.6.5.

Potential impacts resulting from access include removal of wildlife habitat due to roads and trails, disturbance and/or disruption of wildlife movements and seasonal use areas due to vehicular traffic, increased hunting/trapping pressure and other recreation use, and habitat destruction because of new or improved access into remote areas.

The potential impacts resulting from the facilities component are elimination of wildlife habitat due to the construction of gravel pads for structures; disturbance or disruption to wildlife due to human activity associated with the facility; and the removal of grizzly bear, black bear or other animals attracted to solid waste.

ACCESS	FACILITIES	OPERATIONS
Direct (long term) habitat loss	Direct (long term) habitat loss	Direct (long term) habitat loss
Disturbance (short term)/ disruption	Disturbance (short term)/ disruption	Disturbance (short term)/ disruption
Increased (long term) harvest pressure	Removal (long term) of nuisance animals	Hazardous (long term) material spill
Potential (long term) increased habitat loss		

Figure 4-5. Potential impacts to wildlife from mineral development.

Impacts from the operations component would result in loss of wildlife habitat due to removal or covering of vegetation by stripping, making mine cuts, stockpiling, and building settling basins. Disturbance or disruption of wildlife would occur in the vicinity of the operation due to noise from machinery and other activities. There is the unpredictable possibility of spilling diesel fuel, a hazardous material, which would result in contamination and loss of vegetation.

The type of mitigation or management control necessary to alleviate impacts to wildlife resources depends on the type, extent, and overall magnitude of the impact. Measures to avoid, minimize or rectify, and replace wildlife resources that may be impacted by mineral development are presented in Section 4.12, Figure 4-8, Appendix D-2, and Figure D-2a of this document.

4.6.1 Proposed Action

Construction of approximately 221 total miles of permanent gravel roads, excluding the Steese Highway and Circle Hot Springs Road, would result in the loss of 1,339 acres of wildlife habitat in the Birch Creek watershed. Permanent gravel roads directly associated with federal mineral development would total 147.4 miles (893 acres), those directly associated with State and private mineral development would total 21.7 miles (132 acres), and those associated with both federal and State and private mineral developments will total 51.9 miles (314 acres). The establishment and use of 59.3 miles of primitive roads and trails would result in 38,454 acres of wildlife habitat subject to short-term periodic disturbance by vehicular traffic when wildlife such as moose, caribou, and others are present. The existing primitive roads and trails in Birch Creek are used to access federal mineral developments only. The level of vehicular use on roads and trails (excluding the Steese Highway and Circle Hot Springs Road) would be low to moderate, and minimal alteration of wildlife movement routes, disturbance, or disruption of seasonal use areas is anticipated.

Improvement and expansion of access trails and roads into Fryingpan Creek, Great Unknown Creek, Clums Fork, Sheep Creek, portions of Harrison Creek, and other areas of upper Birch Creek would indirectly result in increased harvest of moose, caribou, grizzly bear, black bear, furbearers, and other species. Improving or establishing new access for mining, recreation, and other activities would indirectly facilitate more wildlife habitat loss and disturbance in wildlife use areas over the long- term by enhancing the feasibility of mining more and larger areas.

The increased presence of 80 mining camp facilities and structures in Birch Creek would result in the long-term loss of 80 acres of winter range for moose in Crooked and Harrison Creeks, and their tributaries, the Birch Creek headwaters, and other areas. Facilities directly associated with federal mineral development would total 48 acres, those associated with State and private mineral development total 32 acres. Similarly, 1,440 acres of riparian habitat used by moose and other species would be unavailable for the short term due to frequent human disturbance from May through October. Disturbance at federal mineral development sites account for 864 acres, while State and private activities comprise 576 acres of the total. The removal of grizzly or black bears as nuisance animals due to their attraction to refuse or solid waste in the vicinity of mining facilities could occur.

Activities associated with stripping, mine cuts, stockpiles, and settling basins would result in physical alteration of about 4,919 total acres of moose winter range in Crooked and Harrison Creeks, and their tributaries, the Birch Creek headwaters, and other areas. The habitat lost to mining operations associated with federal mineral development since 1987 would be 1,104 acres, and habitat losses associated with State and private operations would total 736 acres. Reclamation of federal mining areas would occur through leveling tailings, stockpiling and respreading overburden, and natural succession. Reclamation on State and private mining areas would generally consist of leveling tailings and natural succession (as described in Section 2.3). Revegetation in previously undisturbed federal mining areas would probably require 30 years, and revegetation in federal old tailing areas would require at least 50 years (Figure 4-3) to reach a stage suitable for moose browse. Revegetation in previously undisturbed State/private mining areas would require 30 years, and revegetation in State/Private old tailing areas would require at least 50 years (see Figure 4-3) to reach a stage suitable for moose browse. Short-term avoidance by animals of 40,160 total acres of riparian and upland habitat during the summer mining season may occur in these areas due to noise from machinery and other mining activities. Areas subject to disturbance by noise from federal mining would be 24,096 acres, and disturbance from State and private mining would be 16,064 acres. The possibility of hazardous material spills exists and may result in contamination or loss of wildlife habitat.

Conclusion

The effects of the Proposed Action are summarized in Figure 4-6. Approximately 6,258 total acres of wildlife habitat (primarily moose winter range) would be physically altered due to mining- related activities (including roads and facilities) in the Crooked Creek, Harrison Creek, and Birch Creek headwaters areas of the Birch Creek drainage.

Periodic disturbances to wildlife due to use of roads and trails, operation of vehicles and machinery, and human habitation in the Birch Creek watershed totaling 223,000 acres could result in a low to moderate level of short-term adverse effects in localized areas, particularly during May through October. Minimum harvest of wildlife as a direct result of mining activities is anticipated in Birch Creek. The principal long-term adverse effect of new mining in Birch Creek would be the unavoidable loss (even with reclamation) of approximately 947 acres of the moose winter range in Crooked Creek, Harrison Creek, and the Birch Creek headwaters for a 30-50 year period. In addition, approximately 1,354 acres of the area would remain permanently barren or support only sparse vegetation after

50 years. The long-term cumulative loss of habitat to federal (1,104 acres) and State/private (736 acres) mining activities in these areas of Birch Creek would probably contribute to a low to moderate reduction in moose population potential.

The potential exists for long-term cumulative adverse effects to moose, caribou, raptors, furbearers, or other species if human use of the area increases greatly in crucial wildlife habitats (i.e., caribou calving, caribou movement routes, nesting sites). Additionally, the potential exists for a greater long-term loss of wildlife habitat from removal of vegetation due to an increase in mining activity in crucial wildlife habitats. The long-term cumulative effects of potential future disturbance or disruption, and loss of habitat in crucial use areas, could be significant depending on the specific location, timing, amount, and duration of the actions.

4.6.2 Alternative A

Construction of approximately 192.3 total miles of permanent gravel roads, excluding the Steese Highway and Circle Hot Springs Road, would result in the loss of 1,165 acres of wildlife habitat in the Birch Creek watershed. Permanent gravel roads directly associated with federal mineral development would total 128.2 miles (777 acres), those directly associated with State and private mineral development would total 18.9 miles (114 acres), and those associated with federal, State, and private mineral developments would total 45.2 miles (274 acres). The establishment and use of 51.6 miles of primitive roads and trails would result in 33,526 acres of wildlife habitat subject to short-term periodic disturbance by vehicular traffic when wildlife such as moose, caribou, and others are present. The existing primitive roads and trails in Birch Creek are used to access federal mineral developments only. The level of vehicular use on roads and trails (excluding the Steese Highway and Circle Hot Springs Road) would be low to moderate, and minimal alteration of wildlife movement routes, disturbance, or disruption of seasonal use areas is anticipated.

Improvement and expansion of access trails and roads into Fryingpan Creek, Great Unknown Creek, Clums Fork, Sheep Creek, portions of Harrison Creek, and other areas of upper Birch Creek would indirectly result in increased harvest of moose, caribou, grizzly bear, black bear, furbearers, and other species. Improving or establishing new access for mining, recreation, and other activities would indirectly facilitate more wildlife habitat loss and disturbance in wildlife use areas over the long term by enhancing the feasibility of mining more and larger areas.

The increased presence of 70 mining camp facilities and structures in Birch Creek would result in the long-term loss of 70 acres of winter range for moose in Crooked and Harrison Creeks, and their tributaries, the Birch Creek headwaters, and other areas. Facilities directly associated with federal mineral development would total 42 acres, those associated with State and private mineral development total 28 acres. Similarly, 1,260 acres of riparian habitat used by moose and other species would be unavailable for the short term due to frequent human disturbance from May through October. Disturbance at federal mineral development sites account for 756 acres, while State and private activities comprise 504 acres of the total. The removal of grizzly or black bears as nuisance animals due to their attraction to refuse or solid waste in the vicinity of mining facilities could occur.

Activities associated with stripping, mine cuts, stockpiles, and settling basins would result in physical alteration of about 4,689 total acres of moose winter range in Crooked and Harrison Creeks, and their tributaries, the Birch Creek headwaters, and other areas. The habitat lost to mining operations associated with federal mineral development since 1987 would be 966 acres, and habitat losses associated with State and private operations would total 644 acres. Reclamation of federal mining areas would occur through leveling tailings, stockpiling and respreading overburden, and natural succession. Reclamation on State and private mining areas would generally consist of leveling tailings and natural succession (as described in Section 2.3). Revegetation in previously undisturbed federal mining areas would probably require 30 years, and revegetation in federal old tailing areas would require at least 50 years (Figure 4-3) to reach a stage suitable for moose browse. Revegetation in previously undisturbed State/private mining areas would require 30 years, and revegetation in State/private old tailings areas would require at least 50 years (see Figure 4-3) to reach a stage suitable for moose browse. Short-term avoidance by animals of 35,140 total acres of riparian and upland habitat during the summer mining season may occur in these areas due to noise from machinery and other mining activities. Areas subject to disturbance by noise from federal mining would be 21,084 acres, and disturbance from State and private mining would be 14,056 acres. The possibility of hazardous material spills exists and may result in contamination or loss of wildlife habitat.

Conclusion

The effects of the Alternative A are summarized in Figure 4-6. Approximately 5,855 total acres of wildlife habitat (primarily moose winter range) would be physically altered due to mining- related activities (including roads and facilities) in the Crooked Creek, Harrison Creek, and Birch Creek headwaters areas of Birch Creek.

Periodic disturbances to wildlife due to use of roads and trails, the operation of vehicles and machinery, and human habitation in the Birch Creek watershed totaling 193,500 acres could result in a low to moderate level of short-term adverse effects in localized areas, particularly during May through October. Minimum harvest of wildlife as a direct result of mining activities is anticipated in

Moose

Birch Creek. The principal long-term adverse effect of new mining in Birch Creek would be the unavoidable loss (even with reclamation) of approximately 782 acres of the moose winter range in Crooked Creek, Harrison Creek, and the Birch Creek headwaters for a 30-50 year period. In addition, approximately 1,288 acres of the area would remain permanently barren or support only sparse vegetation after 50 years. The long-term cumulative loss of habitat to federal (773 acres) and State/private (515 acres) mining activities in these areas of Birch Creek would probably contribute to a low to moderate reduction in moose population potential.

The potential exists for long-term cumulative adverse effects to moose, caribou, raptors, furbearers, or other species if human use of the area increases greatly in crucial wildlife habitats (i.e., caribou calving, caribou movement routes, nesting sites). Additionally, the potential exists for a greater long-term loss of wildlife habitat from removal of vegetation due to an increase in mining activity in crucial wildlife habitats. The long-term cumulative effects of potential future disturbance or disruption, and loss of habitat in crucial use areas, could be significant depending on the specific location, timing, amount, and duration of the actions.

4.6.3 Alternative B

Alternative B is identical to Alternative A except that the principal long-term adverse effect of new mining in Birch Creek under Alternative B would be the unavoidable loss (even with reclamation) of approximately 886 acres of the moose winter range in Crooked Creek, Harrison Creek, and the Birch Creek headwaters for a 30-50 year period. In addition, approximately 1,185 acres of the area would remain permanently barren or support only sparse vegetation after 50 years. The long-term cumulative loss of habitat to federal (670 acres), and State/private (515 acres) mining activities in these areas of Birch Creek would probably contribute to a low to moderate reduction in moose population potential.

4.6.4 Alternative C

Construction of approximately 161.3 total miles of permanent gravel roads, excluding the Steese Highway and Circle Hot Springs Road, would result in the loss of 978 acres of wildlife habitat in the Birch Creek watershed. Permanent gravel roads directly associated with federal mineral development would total 107.6 miles (652 acres), those directly associated with State and private mineral development would total 15.8 miles (96 acres), and those associated with both federal and State and private mineral developments would total 37.9 miles (230 acres). The establishment and use of 43.3 miles of primitive roads and trails would result in 28,214 acres of wildlife habitat subject to short-term periodic disturbance by vehicular traffic when wildlife such as moose, caribou, and others are present. The existing primitive roads and trails in Birch Creek are used to access federal mineral developments only. The level of vehicular use on roads and trails (excluding the Steese Highway and Circle Hot Springs Road) would be low to moderate, and minimal alteration of wildlife movement routes, disturbance, or disruption of seasonal use areas is anticipated.

Improvement and expansion of access trails and roads into Fryingpan Creek, Great Unknown Creek, Clums Fork, Sheep Creek, portions of Harrison Creek, and other areas of upper Birch Creek would indirectly result in increased harvest of moose, caribou, grizzly bear, black bear, furbearers, and other species. Improving or establishing new access for mining, recreation, and other activities would indirectly facilitate more wildlife habitat loss and disturbance in wildlife use areas over the long term by enhancing the feasibility of mining more and larger areas.

The increased presence of 58 mining camp facilities and structures in Birch Creek would result in the long-term loss of 58 acres of winter range for moose in Crooked and Harrison Creeks, and their tributaries, the Birch Creek headwaters, and other areas. Facilities directly associated with federal mineral development would total 35 acres, those associated with State and private mineral development total 23 acres. Similarly, 1,044 acres of riparian habitat used by moose and other species will be unavailable for the short term due to frequent human disturbance from May through October. Disturbance at federal mineral development sites account for 630 acres, while State and private activities comprise 414 acres of the total. The removal of grizzly or black bears as nuisance animals due to their attraction to refuse or solid waste in the vicinity of mining facilities could occur.

Activities associated with stripping, mine cuts, stockpiles, and settling basins would result in physical alteration of about 4,413 additional acres of moose winter range in Crooked and Harrison Creeks, and their tributaries, the Birch Creek headwaters, and other areas. The habitat lost to mining operations associated with federal mineral development since 1987 would be 805 acres, and habitat losses associated with State and private operations would total 529 acres. Reclamation of federal mining areas would occur through leveling tailings, stockpiling and respreading overburden, and natural succession. Reclamation on State and private mining areas would consist of leveling tailings and natural succession (as described in Section 2.3). Revegetation in previously undisturbed federal mining areas would probably require 25-35 years, and revegetation in federal old tailing areas would require at least 50 years (Figure 4-3) to reach a stage suitable for moose browse. Revegetation in previously undisturbed State/private mining areas would require 25-35 years, and revegetation in State/private old tailing areas would require at least 50 years (see Figure 4-3) to reach a stage suitable for moose browse. Short-term avoidance by animals of 29,116 total acres of riparian and upland habitat during the summer mining season would also occur in these areas due to noise from machinery and other mining activities. Areas subject to disturbance by noise from federal mining sites would be 17,570 acres, and disturbance from State and private mining would be 11,546 acres. The possibility of hazardous material spills exists and may result in contamination or loss of wildlife habitat.

Conclusion

The effects of the Alternative C are summarized in Figure 4-6. Approximately 5,391 total acres of wildlife habitat (primarily moose winter range) would be physically altered due to mining- related activities (including roads and facilities) in the Crooked Creek, Harrison Creek, and Birch Creek headwaters areas of Birch Creek.

Periodic disturbances to wildlife due to use of roads and trails, the operation of vehicles and machinery, and human habitation in the Birch Creek watershed totaling 162,108 acres could result in a low to moderate level of short-term adverse effects in localized areas, particularly during May through October. Minimum harvest of wildlife as a direct result of mining activities is anticipated in Birch Creek. The principal long-term adverse effect of mining in Birch Creek would be the unavoidable loss (even with reclamation) of approximately 1,012 acres of the moose winter range in Crooked Creek, Harrison Creek, and the Birch Creek headwaters for a 25-50 year period. In addition, approximately 782 acres of the area would remain permanently barren or support only sparse vegetation after 50 years. The long-term cumulative loss of habitat to federal (472 acres) and State/private (310 acres) mining activities in these areas of Birch Creek would probably contribute to a low to moderate reduction in moose population potential.

The potential exists for long-term cumulative adverse effects to moose, caribou, raptors, furbearers, or other species if human use of the area increases greatly in crucial wildlife habitats (i.e., caribou calving, caribou movement routes, nesting sites). Additionally, the potential exists for a greater long-term loss of wildlife habitat from removal of vegetation due to an increase in mining activity in crucial wildlife habitats. The long-term cumulative effects of potential future disturbance or disruption, and loss of habitat in crucial use areas could be significant depending on the specific location, timing, amount, and duration of the actions.

4.6.5 Alternative D

Approximately 131.8 miles of permanent gravel roads, excluding the Steese Highway and Circle Hot Springs Road, and associated loss of 799 acres of wildlife habitat in the Birch Creek watershed would remain if Alternative D is implemented. Permanent gravel roads directly associated with past federal mineral development totaling 58.2 miles (353 acres) would remain in place. However, those roads directly associated with State and private mineral development would total 73.6 miles (446 acres), and those formerly associated with both federal and State and private mineral development would be used for State and private operations only. The continued use of 65.9 miles of primitive roads and trails would result in 42,678 acres of wildlife habitat being subject to short-term periodic disturbance by vehicular traffic when wildlife such as moose, caribou, and others are present. The existing primitive roads and trails in Birch Creek would be used to access State and private mineral developments only if Alternative D is adopted. The level of vehicular use on roads and trails (excluding the Steese Highway and Circle Hot Springs Road) would probably increase because of non-

Porcupine

mineral development activities (recreation). No alteration of wildlife movement routes, disturbance, or disruption of seasonal use areas directly attributable to federal mining access would occur.

Recreation and other use of the access trails into Fryingpan Creek, Great Unknown Creek, Clums Fork, Sheep Creek, portions of Harrison Creek, and other areas of upper Birch Creek would continue to result in increased harvest of moose, caribou, grizzly bear, black bear, furbearers, and other species. Improving or establishing new access for State and private mining activities may indirectly facilitate more wildlife habitat loss and disturbance in wildlife use areas over the long term by enhancing the feasibility of mining more and larger areas. Improving access or establishing new access for federal mining activities would not occur.

Facilities associated with federal mining camps in Birch Creek would be removed. Those facilities associated with State and private mineral development would result in long-term loss of 32 total acres of winter range for moose in Crooked and Harrison Creeks and their tributaries. Similarly, 576 acres of riparian habitat used by moose and other species would be unavailable for the short-term due to frequent human disturbance during May through October at State and private mineral development sites. Federal sites would not operate and would be reclaimed. The potential exists for grizzly or black bears to be removed as nuisance animals because of their being attracted to refuse or solid waste in the vicinity of State and private mining facilities only.

Past activities associated with stripping, mine cuts, stockpiles, and settling basins have resulted in physical alteration of approximately 3,079 total acres of moose winter range in Crooked and Harrison Creeks, and their tributaries, the Birch Creek headwaters, and other areas. The habitat lost to mining operations associated with federal mineral development since 1987 would remain at 220 acres. Additional future habitat losses associated with State and private operations would total 736 acres. Reclamation of federal mining areas would consist of leveling tailings and respreading of available overburden. Reclamation on State and other mining areas would consist of leveling tailings and natural succession. Revegetation in federal mining areas would require approximately 40-50 years. Revegetation in previously undisturbed State and other mining areas would require 40-50 years, and revegetation in State/private old tailings areas would require at least 50 years (see Figure 4-3) to reach a stage suitable for moose browse. Short-term avoidance of 16,064 total acres of riparian habitat during the summer mining season would occur in State and private mine areas due to noise from machinery and other mining activities. Disturbance in the vicinity of federal mining sites would not occur. The possibility of spilling diesel fuel, a hazardous material, exists at the State and private mines and may result in contamination or loss of wildlife habitat.

Conclusion

The effects of the Alternative D are summarized in Figure 4-6. Approximately 4,834 total acres of moose winter range would remain physically altered because of past mining-related activities (including roads and facilities) in the Crooked Creek, Harrison Creek, and Birch Creek headwaters of the Birch Creek drainage. New physical alteration of habitat associated with State and private operations would total 736 acres.

Periodic disturbances to wildlife from use of roads and trails, mining vehicles and machinery, and human habitation at State and private mines in the Birch Creek watershed would result in 144,122 acres being subject to minimal short-term adverse effects in localized areas during May through October. Past disturbances from federal operations would cease. Recreation use of existing roads and trails and additional State and private roads and trails would facilitate increased harvest of wildlife in Birch Creek. The principle long-term adverse effect of past mining in Birch Creek would be the unavoidable loss (even with reclamation) of approximately 609 acres of moose winter range for 40-50 years. Additional habitat losses in State and private mining areas (147 acres) would require approximately 50 years to become suitable for wildlife use. In addition, approximately 588 acres of the area would remain permanently barren or support only sparse vegetation after 50 years. The long-term cumulative loss of habitat to mining in this portion of Birch Creek would continue to contribute to a moderate reduction in moose population potential.

The potential exists for long-term cumulative adverse effects to moose, caribou, raptors, furbearers, or other species if human use of the area increases greatly in crucial wildlife habitats. Additionally, the potential exists for a greater long-term loss of wildlife habitat from removal of vegetation due to a possible increase in State and private mining activity in crucial wildlife habitats. The long-term cumulative effects of potential future State and private mining disturbance or disruption, and loss of habitat in crucial use areas could be significant depending on the specific location, timing, amount, and duration of the State and private mineral development activities.

4.6.6 Special Considerations

Unavoidable Adverse Impacts

Unavoidable short-term impacts occur from mineral development. Species that are sensitive to noise, odors, movement, and the presence of human activity are most affected by mining activities and will avoid areas where these actions occur. Construction and use of facilities, operation of mining equipment, and increased vehicular traffic for access result would be an unavoidable adverse effect to wildlife. Mining roads and trails are generally not removed or closed to present or future public use. This situation facilitates an increase in human use of wildlife and other resources over the long term. Over the long term, the extent, frequency, and duration of the activities determine the degree of disturbance or disruption.

Natural recovery of wildlife habitat is slow in areas that have been disturbed by mineral development. Reclamation practices can facilitate or enhance the recovery of wildlife habitat in disturbed areas; nevertheless, the affected habitat may be lost for 25 to 50 years. The principal habitats that are unavoidably lost over the long term for this time are the riparian habitats that are especially important to moose as winter range. Furthermore, previously-mined areas that are subjected to additional, new mining are the principle source of permanent habitat loss because fine material and other basic soil components are not available for use in reclamation. It is possible for localized extirpation or reduction beyond minimum viable population levels to occur if the overall extent of habitat loss is large and the duration is long term.

Action Component/ Potential Impact		Proposed Action	Alternative A	Alternative B	Alternative C	Alternative D
Permanent roads result in habitat loss	Extent	Federal: 147.4 miles/893 acres	128.2 miles/777 acres	128.2 miles/777 acres	107.6 miles/652 acres	58.2 miles/353 acres
		State/Private: 21.7 miles/132 acres	18.9 miles/115 acres	18.9 miles/115 acres	15.8 miles/96 acres	73.6 miles/446 acres
		Joint: 51.9 miles/314 acres	45.2 miles/274 acres	45.2 miles/274 acres	37.9 miles/230 acres	0 / 0
		Total: 221.0 miles/1,339 acres	192.3 miles/1,166 acres	192.3 miles/1,166 acres	161.3 miles/978 acres	131.8 miles/799 acres
	Duration	Mine life & beyond	Mine life & beyond	Mine life & beyond	Mine life & beyond	Mine life & beyond
	Frequency	Annually	Annually	Annually	Annually	Annually
Use of roads/trails can disrupt normal wildlife use patterns[2]	Extent	Federal: 206.7 miles/133,292 acres	179.8 miles/116,076 acres	179.8 miles/116,076 acres	150.9 miles/97,580 acres	124.1 miles/80,428 acres[1]
		State/Private::51.7 miles/14,390 acres	18.9 miles/12,598 acres	18.9 miles/12,598 acres	15.8 miles/10,614 acres	73.6 miles/47,606 acres
		Joint: 51.9 miles/33,718 acres	45.2 miles/29,430 acres	45.2 miles/29,430 acres	37.9 miles/24,758 acres	0 / 0
		Total: 280.8 miles/181,400 acres	243.9 miles/157,100acres	243.9 miles/157,100 acres	204.6 miles/131,948 acres	197.7 miles/127,532 acres
	Duration	6 months (May – Oct) All months for recreation use	6 months (May – Oct) All months for recreation	6 months (May – Oct) All months for recreation	6 months (May – Oct) All months for recreation	Federal: NO EFFECT[1] State/Private: 6 months(May – Oct) all months for recreation use
	Frequency	Intermittent	Intermittent	Intermittent	Intermittent	Intermittent
Use of trails enhances access & increases harvest	Extent	Federal: 59.3 miles/38,454 acres	51.6 miles/33,526 acres	51.6 miles/33,526 acres	43.3 miles/28,214 acres	65.9 miles/42,678 acres[1]
		State/Private: 0/0	0 / 0	0 / 0	0 / 0	0 / 0
		Joint: 0/0	0 / 0	0 / 0	0 / 0	0 / 0
		Total: 59.3 miles/38,454 acres	51.6 miles/33,526 acres	51.6 miles/33,526 acres	43.3 miles/28,214 acres	65.9 miles/42,678 acres
	Duration	Mine life & beyond	Mine life & beyond	Mine life & beyond	Mine life & beyond	Present, & beyond
	Frequency	Annually	Annually	Annually	Annually	Annually
Potential upgrading of roads/ trails & more roads/ trails can increase habitat loss, disturbance, & harvest	Extent	Federal: Unpredictable, but greater	Unpredictable, but greater	Unpredictable, but greater	Unpredictable, but greater	NO EFFECT[1]
		State/Private:Unpredictable, but greater	Unpredictable, but greater	Unpredictable, but greater	Unpredictable, but greater	Unpredictable, but greater
	Duration	Mine life & beyond All months for recreation use	Mine life & beyond All months for recreation	Mine life & beyond	Mine life & beyond	Federal: NO EFFECT[1] State/Private:Mine life & beyond, all months for recreation use
	Frequency	Annually	Annually	Annually	Annually	Annually
Gravel pads etc. remove/ cover habitat	Extent	Federal: 48 acres	42 acres	42 acres	35 acres	39 acres [4]
		State/Private: 32 acres	28 acres	28 acres	23 acres	32 acres
		Total: 80 acres	70 acres	70 acres	58 acres	32 acres
	Duration	Federal: Mine life plus 50 years	Mine life plus 50 years	Mine life plus 30 – 50 years	Mine life plus 25 – 35 years	50 years [4]
		State/Private: Mine life plus 50 years	Mine life plus 50 years	Mine life plus 50 years	Mine life plus 25 – 35 years	Mine life plus 50 years
	Frequency	Annually	Annually	Annually	Annually	Annually
Human habitation can cause disturbance/ disruption	Extent	Federal: 864 acres	756 acres	756 acres	630 acres	NO EFFECT
		State/Private: 576 acres	504 acres	504 acres	414 acres	576 acres
		Total: 1,440 acres	1,260 acres	1,260 acres	1,044 acres	576 acres
	Duration	6 months (May – Oct)	6 months (May – Oct)	6 months (May – Oct)	6 months (May – Oct)	Federal: NO EFFECT State/Private: 6 months (May – Oct)
	Frequency	Annually	Annually		Annually	Annually

continuation

Action Component/ Potential Impact		Proposed Action	Alternative A	Alternative B	Alternative C	Alternative D
Improper solid waste disposal may attract nuisance animals	Extent	Federal: 1 – 3 bears	1 – 3 bears	1 – 3 bears	1 – 3 bears	NO EFFECT
		State/Private: 1 – 3 bears	1 – 3 bears	1 – 3 bears	1 – 3 bears	1 – 3 bears
	Duration	6 months (May – Oct)	6 months (May – Oct)	6 months (May – Oct)	6 months (May – Oct)	Federal: NO EFFECT
						State/Private: 6 months (May – Oct)
	Frequency	Annually	Annually	Annually	Annually	Annually
Stripping, mine cuts, stockpiles & ponds remove/ cover habitat	Extent	Federal: 1,104 acres	968 acres	966 acres	805 acres	0[4]
		State/Private: 736 acres	644 acres	644 acres	529 acres	736 acres
		Total: 4,919 acres	4,689 acres[3]	4,688 acres[3]	4,413 acres[3]	3,815 acres[3]
	Duration	Federal: Mine life plus 50 years	Mine life plus 30 – 50 years	Mine life plus 30 – 50 years	Mine life plus 25 – 35 years	Mine life plus 40 – 50 years[4]
		State/Private: Mine life plus 50 years	Mine life plus 30 – 50 years	Mine life plus 30 – 50 years	Mine life plus 25 – 35 years	Mine life plus 40 – 50 years
	Frequency	Annually	Annually	Annually	Annually	Annually
Operation of machinery can disrupt normal wildlife use patterns	Extent	Federal: 24,096 acres	21,084 acres	21,084 acres	17,570 acres	NO EFFECT
		State/Private: 16,064 acres	14,056 acres	14,056 acres	11,546 acres	16,064 acres
		Total: 40,160 acres	35,140 acres	35,140 acres	29,116 acres	16,064 acres
	Duration	6 months (May – Oct)	6 months (May – Oct)	6 months (May – Oct)	6 months (May – Oct)	Federal: NO EFFECT
						State/Private: 6 months (May – Oct)
	Frequency	Annually	Annually	Annually	Annually	Annually
Hazardous material spills result in habitat loss	Extent	Federal: Unpredictable	Unpredictable	Unpredictable	Unpredictable	NO EFFECT
		State/Private: Unpredictable	Unpredictable	Unpredictable	Unpredictable	Unpredictable
	Duration	Federal: 50 years	30 – 50 years	30 – 50 years	25 – 35 years	NO EFFECT
		State/Private: 50 years	30 – 50 years	30 – 50 years	25 – 35 years	50 years
	Frequency	Unpredictable	Unpredictable	Unpredictable	Unpredictable	Unpredictable

[1] Due to State/Private mineral development, recreation or other uses; none directly attributable to Federal mineral development.

[2] Maximum total area subjected to disturbance by use of roads/trails when/if wildlife are present.

[3] Includes pre – 1981 disturbance acreage.

[4] Reclamation will be conducted on areas presently disturbed with minimum available fines.

Figure 4 – 6. Summary and comparison of probable effects on wildlife resources in relation to the proposed action and alternatives.

The potential for an overall increase in the level of cumulative impacts on wildlife and habitat exists. This could occur because of the accumulation of small, apparently insignificant, residual impacts to wildlife resources over time. This unavoidable impact could become substantial over the long term if conflicts between wildlife values, mineral development, increased visitor use, and a greater demand for human use of the wildlife resource are not adequately mitigated.

Short-Term Uses vs Long-Term Productivity

The long-term productivity of wildlife habitat subject to mineral development activities would depend on 1) the extent and timing of mineral development activities, 2) the success of mitigative measures or management controls to minimize the alteration and disturbance of normal wildlife use patterns, and 3) the successful reclamation of habitat that has been physically altered, removed, or lost.

Even the successful implementation of management controls to avoid, minimize, or replace lost habitat cannot prevent the possibility of a reduction in the long-term opportunity for increasing the potential moose population in the area. Specifically, the area has supported a larger population of moose in the past and the existing habitat has the potential to support a larger population. The present moose population is not at carrying capacity. The loss of existing moose habitat, especially late winter range, due to mineral development activities would reduce carrying capacity and could compromise the ADF&G management goal of increasing the moose population over the long term. The potential for optimal numbers of moose would be lowered because the habitat carrying capacity will have been lost or reduced due to mineral development. The degree of impact to the moose population potential in the region due to mineral development would depend on the overall extent and duration of the habitat loss.

Irreversible and Irretrievable Commitments of Resources

Wildlife and habitat are renewable resources over the long term. If the mitigative measures designed to avoid, minimize, and monitor the adverse effects and to replace habitat physically altered by mineral development were fully and successfully employed, there would be little irreversible or irretrievable commitment or permanent loss of wildlife habitat over the long term. Previously-mined areas that are subjected to additional, new mining are the principle source of permanent habitat loss because fine material and other basic soil components are not available for use in reclamation.

4.6.7 Threatened or Endangered Animals

Impacts Common to All Alternatives

The Proposed Action and alternatives are anticipated to have no effect on the endangered peregrine falcon. Each operator is required to take such action as may be needed to prevent adverse impacts to threatened or endangered species, pursuant to 43 CFR 3809.2-2(d).

Protective Measures

Each proposal to conduct mining activities is evaluated by BLM on a case-by-case basis for potential conflicts with the peregrine falcon. As a result, the recommended protective measures of the Peregrine Falcon Recovery Plan (USFWS 1982), informal consultation with the USFWS, or formal consultation with the USFWS may be employed by BLM, if necessary. The standard mitigation or protective measures recommended by the USFWS are:

Within one mile of nest sites:

1. Require aircraft to maintain minimum altitudes of 1500 feet above nest level from April 15 through August 31.

2. Prohibit all ground level activity from April 15 through August 31, except on existing thoroughfares.

3. Prohibit habitat alterations or the construction of permanent facilities.

Within two miles of nest sites:

1. Prohibit activities having high noise levels from April 15 through August 31.

2. Prohibit permanent facilities having high noise levels or sustained human activity, or the altering of limited, high quality habitat (e.g., ponds, lakes, wetlands, and riparian habitats).

Within 15 miles of nest sites:

1. Prohibit alteration of limited, high quality habitat which could detrimentally and significantly reduce prey availability. Of particular concern are ponds, lakes, wetlands, and riparian habitats.

2. Prohibit use of pesticides; the only exception may be limited non-aerial application of approved non-persistent insecticides at supply bases.

Unavoidable Adverse Impacts

No unavoidable adverse impacts are anticipated to result from implementation of the Proposed Action or the alternatives.

Short-Term Uses vs Long-Term Productivity

No adverse impact to the long-term productivity of the peregrine falcon is anticipated to result from implementation of the Proposed Action or the alternatives.

Irreversible and Irretrievable Commitments of Resources

No irreversible or irretrievable commitment or permanent loss of peregrine falcon habitat is anticipated to result from implementation of the Proposed Action or the alternatives.

4.7 Fisheries

Placer mining may adversely affect aquatic systems directly through habitat disruption or physical alteration, and indirectly through point and non-point discharges of waste waters (Figure 4- 7). Direct impacts to the aquatic community include the destruction of instream habitat, disruption of riparian zones, and creation of migration barriers. Indirect impacts to the aquatic community result from increased levels of trace metal contaminants, increased turbidity and suspended sediment, increased levels of settleable solids, increased imbeddedness of stream substrates, decreased food

	DIRECT EFFECTS	INDIRECT EFFECTS
Actions which physically alter the Aquatic Habitat	Loss of Instream Habitat	Straight\monotypic stream channel Increased water velocity Decreased pools
	Loss of Streamside (Riparian) Habitat	Unstable banks Decreased temperature control Decreased detrital nutrient input Decreased debris recruitment
	Creation of Migration Barriers	Decrease in suitable habitat
Discharge of Wastewater	Increased Suspended Sediment/Turbidity	Increase trace metals Decreased light penetration, which leads to decreased primary production Decreased incubation and rearing suitability for fish Decreased incubation and rearing suitability for aquatic insects Interference with fish migration, which leads to decreased available habitat Decreased opportunity for recreational fishing
	Increased Settleable Solids/Sediment	Decreased aquatic insect density, biomass, diversity which leads to decreased fish food supply Increased stream substrate imbeddedness Increased smothering of incubating eggs

Figure 4-7. Direct and indirect effects of physically altering the aquatic habitat and the discharging wastewater.

supply for fish, long-term changes in channel configuration, and long-term disruption of riparian habitats. The overall severity of these effects on aquatic communities depends on their magnitude, frequency, and duration.

Effects on Aquatic Habitats

Numerous studies have addressed the effects of placer mining on chemical water quality of affected streams. Many of these studies have identified alterations in chemical components. In some cases, levels of trace metals like arsenic, cadmium, copper, lead, mercury, and zinc exceeded drinking water and aquatic life protection standards. Dames and Moore (ADEC 1986) provides a summary discussion of these data. The general conclusion by all studies is that concentrations of certain trace metals were increased below mining activity. The increased total concentrations of trace metals below mining activity may pose a threat to aquatic animals if a significant portion of the total recoverable metals dissolve and are biologically available. There is a positive relationship between total recoverable and dissolved fractions of the metals. Therefore, it follows that reductions in sediment inputs from mining could substantially reduce metals concentrations in the affected streams (ADEC 1986, LaPerriere et al 1985).

The biological significance of this conclusion is complicated by several factors. The sensitivities of arctic grayling and other organisms are not well known; the speciation of some of the metals is not known; the degree of tolerance of the local organisms is unquantified; and the proportion of metals that is biologically available versus that which is totally recoverable is unknown. All of these uncertainties contribute to the difficulty of assessing the biological significance of these data.

Increases in total suspended solids (TSS) levels in streams with placer mining and in receiving waters downstream are the most significant impacts of mining activity. Many studies document increases in suspended sediment concentrations of several orders of magnitude over background levels as a result of placer mining. The degree or magnitude of increase is highly variable and is a function of regional geology, type of mining operation, and effectiveness of waste water treatment.

Placer mining affects the physical habitat in a stream through destruction of the channel, and removal of the organic overburden of the banks and riparian zone adjacent to the stream. The post mining stream channel is usually straight and the streams usually flow along bedrock with no pools, velocity barriers or other migratory blocks (e.g., settling pond dams).

The disruption of riparian habitat along the stream is a major impact from placer mining. This riparian habitat is important for bank stabilization, detrital nutrient input, temperature control, and debris recruitment. Weber and Post (1985) reported mined areas over 60 years old where riparian vegetation covered only 25% of the banks. As with reestablishment of the channel morphology, the regeneration of the riparian vegetation requires long periods in the subarctic environment. These processes can be expected to take in excess of 100 years on unreclaimed streams. These unavoidable impacts of placer mining on the aquatic system are typically long-term, and may remain even with reclamation measures.

Effects on Aquatic Populations

Light penetration is crucial to primary production in aquatic ecosystems. Turbid conditions that reduce light penetration will reduce primary productivity. In turn, the effects of reductions in primary productivity are transmitted up the food chain and can ultimately result in reduced populations of fish and their prey organisms.

The general lack of streamside forest or canopy cover over some subarctic streams suggests that these streams may be highly dependent on instream productivity to support the higher lifeforms present in them. Reductions in primary productivity could lead to reductions in biomass of aquatic invertebrates and ultimately to reductions in fish biomass, at least in the higher elevation headwater areas. Destruction of the riparian vegetation along forested streams also reduces carbon inputs from leaf litter.

Sediment and/or turbidity adversely affect aquatic invertebrate density, biomass, and diversity. Studies demonstrate that increasing suspended and deposited sediment can lead to smothering and reduced respiratory efficiency of aquatic insects, abrasion, interference with filter feeders and net spinners, reduced food resources for grazers, cementing or increases in imbeddedness, and filling of crevices among larger cobbles. All of these actions result in habitat alterations that make the stream unsuitable for many species of aquatic organisms.

Weber and Post (1985) made comparisons of invertebrate populations above and below mining activity and compared unmined versus previously mined streams. In all cases, average densities of invertebrates decreased at sites below mining activity when compared to upstream controls. In many cases, whole families and one entire order (*Trichoptera*, caddis flies) disappeared below mining. In streams which had experienced previous mining activity, invertebrate densities were about 37% lower than unmined streams. In streams below active mining, invertebrate densities were reduced by nearly 90% compared with control stream segments.

The effects of reduced food supply and therefore reduced fat storage on overwinter survival and long-term fitness may be an important effect of placer mining on fish populations. It is possible that even if grayling were able to survive the summer in water heavily loaded with suspended sediments that they would be unable to store the same fat reserves accumulated by fish in clearwater areas. Therefore, they could be adversely affected in their overwinter survival, hampered in their upstream migration to spawning areas in the spring, and/or may be less able to produce viable gametes for successful reproduction. Overall, this could lead to a lower reproductive fitness of these fish populations and could lead to their possible elimination over time.

Numerous studies have been conducted to assess the effects of fine sediments on fish populations. Direct effects of suspended sediments on fish begin to be observed somewhere in the range of 50 to 100 mg/l (Herbert and Merkens 1961, EIFAC 1965, Noggle 1978, Berg 1982, McLeay et al 1983, 1984, Simmons 1984, Lloyd 1985, Chapman and McLeod 1987, McLeay et al 1987). EIFAC (1965) determined that no adverse effects of suspended sediments were demonstrated on fish at or below 25 mg/l. They further concluded that good to moderate fisheries could be expected with suspended sediment concentrations between 20 and 80 mg/l. At concentrations above 80 mg/l it was considered unlikely that good fisheries could be maintained, and about 400 mg/l, only poor fisheries were to be expected.

McLeay et al (1983, 1984, 1987) conducted an extensive series of experiments concerning the effects of sediments from placer mining on Arctic grayling. They found lethal and sublethal effects from acute exposure at concentrations of 50,000 to 250,000 mg/l and chronic exposure up to 1,000 mg/l. Chronic exposures for six weeks to concentrations greater than 100 mg/l impaired feeding, caused reductions in growth rates, showed changes in coloration, and caused downstream displacement of experimental fish. Stress, as measured by changes in blood chemistry, was reported in fish exposed for short periods to sediment concentrations as low as 50 mg/l. It was noted that downstream displacement and the resultant decrease in suitable habitat were of particular concern in maintaining healthy fish populations in streams exposed to placer mining.

Investigations have been conducted to determine the effects of placer mining on grayling distribution (Mathers et al 1981, Weber and Post 1985, ADEC 1986). In two of these studies (Weber and Post 1985, ADEC 1986), fish were found in clear water tributaries of mined streams and in unmined streams but none were found in streams affected by mining. Mathers et al (1981) found adult grayling in almost all streams they sampled but no juvenile fish were found in three streams heavily affected by mining. Mathers et al found adult grayling in suspended sediment concentrations as high as 4,453 mg/l. However, they were unable to determine if these fish were residing in these conditions or were moving downstream to escape the high sediment loads. In one stream with suspended sediment concentrations over 7,000 mg/l no grayling were found.

Sediment impacts to incubating eggs may have been the cause for the absence of grayling fry in three streams sampled by Mathers et al (1981). Grayling broadcast their eggs over gravel or other substrates making no effort to produce a redd as is common with trout and salmon (Reed 1964). Eggs exposed on the surface of the substrate are susceptible to smothering by sediment deposition from mining activities. This effect may have contributed to the apparent lack of spawning success noted by Mathers et al.

Physical disturbance of stream channels may be another factor that affected grayling distribution (ADEC 1986). Data suggests that long reaches of disturbed channels with potential passage barriers restricts migration into some clearwater tributaries and therefore affects access to available habitat in some river basins. This could adversely affect the ability of a basin affected by mining to support a grayling population.

4.7.1 Proposed Action

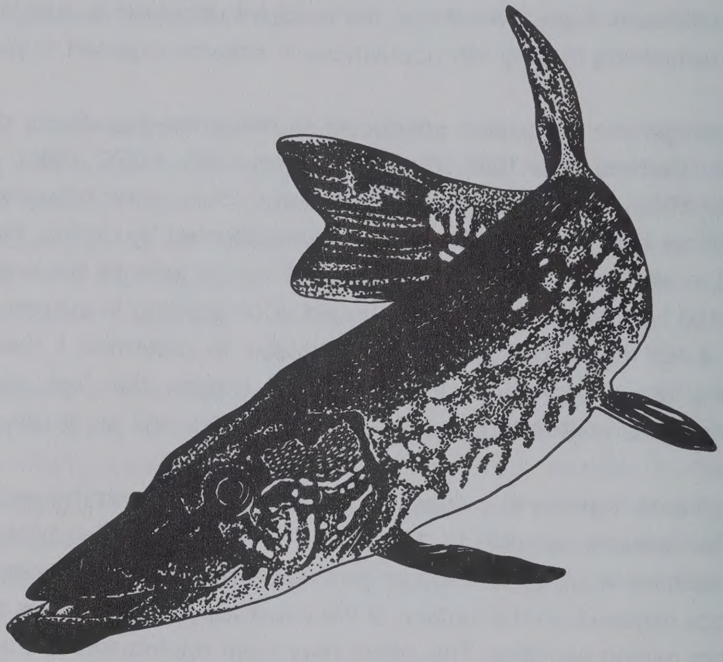
Concentrations of arsenic, copper, lead, mercury, or other trace metals would increase in areas below mining activities. The biological significance of the increased metals concentrations is not known. The magnitude of the increase would be a function of geology at mine sites, type of mining operation and effectiveness of wastewater treatment.

Mining operations would increase the total suspended sediment downstream from affected areas. The magnitude of impacts from increased suspended sediment and increased turbidity would be a function of geology at the mine sites and effectiveness of wastewater treatment.

Bjerklie and LaPerrier (1985) documented reduced hydraulic connection between surface and subsurface waters as an indirect effect of sediment on groundwater. The result of increased sediment in these circumstances is a lowering of the groundwater below the stream and a significant reduction in dissolved oxygen in mined streams. This condition could result in a reduction in overall quantity and quality of overwintering habitat and has been known to be directly harmful to fish eggs and aquatic insect larvae that may be present in the substrate materials.

Mining activities would reduce primary productivity in areas affected by increased suspended sediment and turbidity. The magnitude of reduction of primary productivity would be a function of geology at the mine sites and effectiveness of wastewater treatment.

The average density (abundance) and diversity of aquatic insects would be decreased downstream of mining activities. The magnitude of the impact on aquatic insects would be a function of total suspended sediment concentrations. These concentrations are, in turn, a function of geology at the mine sites and the effectiveness of wastewater treatment.



Northern Pike

The direct effects of mining operations would be habitat degradation due to physical alteration and possible blockage of fish migration. Streams in excavated areas develop new channels through the tailings and over exposed bedrock. These channels are usually shallow with few pools, have little instream cover, are unstable during breakup, and are generally poor habitat for fish and aquatic insects. These areas may also contain barriers to fish migration resulting in the reduction of available habitat in upstream areas. The physical alteration at the mines would also result in the loss of riparian vegetation which, under normal conditions, provides bank stability, instream cover, temperature control, and detrital nutrient input.

Stream segments directly affected by mining operations are not expected to support arctic grayling or other species. However, clearwater tributaries and other areas in the basin would continue to support all age classes and sizes, including fry, of grayling and other species. The overall magnitude of adverse affect to fish populations is not possible to determine. The combined effect of the mining operations would at least partially eliminate grayling from the mined reaches of the streams. The magnitude of the impacts to fish populations would probably be a function of the extent of migration blockages due to physical barriers and/or sediment concentrations, and the extent of rearing habitat lost. Habitat suitability in the streams affected by mining would be adversely affected by increased toxic metals concentrations, reduced food supply, reduced cover and refuge habitat, and reduced visibility for feeding. Spawning habitat in unaffected streams is expected to provide some recruitment for the affected areas if they remain accessible to fish, and if the habitat is suitable for rearing.

Recreation use of sport fish in areas where mining occurs can be adversely affected by increased turbidity or suspended sediment below the mines. The degree of the impact to sport fishing opportunities would be a function of the success of wastewater treatment.

Conclusions

Physical alteration of 20 miles of streams (12 miles due to federal claims, eight miles on State/private) and increases in suspended sediment from 80 mines in the basin would result in adverse cumulative effect on the aquatic resources. The clear flowing headwater reaches of streams that are blocked to fish passage would also be unavailable as habitat to some fish populations and increase the affected area. The most likely locations are the upper tributaries of the North Fork of Birch Creek, Harrison Creek, Clums Fork, and Crooked Creek. Some of the projected mining activity would probably be in areas previously mined or dredged. Reclamation and stabilization of previously disturbed streams and bypasses may improve physically altered fish habitat over the long-term. The overall cumulative adverse effect of total suspended sediment increases in Birch Creek cannot be determined. These effects would be a function of geology at individual mine sites and effectiveness of wastewater treatment.

The duration of effects on aquatic resources would be a function of magnitude of habitat disruptions, the recovery of physical habitat, and recolonization by fish and aquatic insects. Aquatic invertebrate populations are expected to exhibit rapid recolonization because most of these organisms use an aerial adult stage (fly) for dispersion and propagation if there is suitable instream and streamside habitat present. Restoration of the river/stream channel to approximate natural conditions is the situation most suitable for recovery and recolonization of aquatic resources.

4.7.2 Alternative A

Effects on fish habitat due to water quality changes are anticipated to be approximately the same as those of the Proposed Action. Impacts could be less because there would be no EPA variances as are allowed under the Proposed Action. Some detectable increase in the sediment load and turbidity of the mined streams would result during the production phase of the operations; however, this increase and accumulation of sediment would not be detectable relative to the fish habitat downstream because of the amount of dilution and large amounts of sediment transported during spring breakup. Increases in trace metal concentrations are expected to be less than under the Proposed Action with the magnitude of impact dependent on geology of mine site, type of operation, and effectiveness of wastewater treatment.

Cumulative impacts are similar to those described for the Proposed Action. The degree of impact depends on the assumption that all federal mining operations would meet water quality performance standards (as described in Section 2.3).

Seventy placer mines are projected (42 federal, 28 State/private) with disturbance along 17.5 miles (10.5 federal, seven State/private) of stream in North Fork Birch Creek, Harrison Creek, Clums Fork, Crooked Creek, and other streams. Some areas may be remined, and reclamation requiring stabilization of the stream bypass may enhance previously disturbed fish habitat. In areas of mining in previously unmined streambed, the stream would be channeled into a bypass. This would reduce fish habitat as bypasses are generally straight, with no pools, and flow at a faster velocity than the original stream channel.

4.7.3 Alternative B

Impacts from Alternative B would be very similar to those listed under Alternative A. The 70 mines (42 federal, 28 State/private) would impact approximately 17.5 miles (10.5 federal, seven State/private) of stream. The enhanced reclamation standards for Alternative B would probably increase the rate and amount of revegetation along the riparian zone. This would ultimately decrease the sedimentation from non-point erosion, increase the bank stability, instream cover, temperature control, and detrital nutrient input.

4.7.4 Alternative C

Fifty-eight mining operations (35 federal, 23 State/private) are projected to operate with the performance standards outlined for Alternative C. Operations that meet the water quality standards would result in minimal contribution of sediment or increased turbidity to the streams. The reclamation standards would result in more rapid regrowth of the riparian vegetation (25-30 years), and reduce the amount of non-point sedimentation. The 58 mines would disturb approximately 14.5 miles (8.75 federal, 5.75 State/private) of stream channels in North Fork Birch Creek, Harrison Creek, Clums Fork, Crooked Creek, and other streams. The standards require rebuilding the stream channel in the original floodplain with pools, riffles, boulders, and approximately the original gradient. This replacement of habitat would minimize the long-term impacts to fish habitat. Areas that are remined in old dredged tailings would result in enhanced fish habitat after reclamation of the present bypass.

4.7.5 Alternative D

There would be no further impact on the fishery resources attributable to federal mining activities because there would be no additional mining to cause surface disturbance. Some erosion and turbidity could occur from past federal mining disturbance where reclamation has not been conducted. Also, increased turbidity would occur where reclamation is taking place on federal areas disturbed from mining since 1981.

Physical alteration of eight miles of stream and increases in suspended sediment from 32 State/private mining operations would result in adverse effects on aquatic resources. The principle streams directly affected by the State/private operations in Birch Creek would be the North Fork Birch Creek and Crooked Creek. The overall magnitude of the affects attributable to State/private mining can not be determined. The magnitude effects would be a function of the geology at individual mine sites and effectiveness of wastewater treatment.

4.7.6 Special Considerations

Unavoidable Adverse Impacts

The degree or magnitude of unavoidable adverse affects is dependent on geology at the mine sites, type and duration of the operations, success of wastewater treatment, and reclamation of disturbed areas.

Placer mining results in unavoidable adverse affects on aquatic habitat. The total concentration of certain trace metals would increase below mining activity. Increases in total suspended sediment levels in streams with placer mining and in downstream receiving waters would occur. Physical alteration of riparian habitat along the stream, as well as in the stream unavoidably results in long-term adverse affects.

Unavoidable adverse affects occur to aquatic populations as a result of placer mining. Turbid conditions would reduce light penetration and would primarily reduce productivity. Increases in sediment/turbidity would also result in unavoidable adverse affects to aquatic insect density, diversity, and biomass. This in turn results in reduced food supply for fish in affected streams. Placer mining may affect the distribution of fish in streams affected by mining if, or when passage barriers and/or high suspended sediment concentrations are present.

Short-Term Uses vs Long-Term Productivity

The long-term productivity of fish habitat would depend on the extent and timing of the mining development, adherence to performance standards, success of reclamation efforts where the habitat has been physically altered, and level of mitigation required. The short-term use by mining that affects the long-term productivity of aquatic resources results in losses of desirable in stream and streamside habitat, and degradation of water quality from channel changes, increased channel gradients, and sedimentation of stream substrate.

Irreversible and Irretrievable Commitment of Resource

There would be no irreversible or irretrievable commitments of the fishery resources if mitigation measures are followed and performance standards are met.

4.8 Cultural Resources

4.8.1 Proposed Action

Under the Proposed Action all federal Notice and Plan operations would be reviewed by a cultural resources specialist. A Class I Inventory would be done; this consists of a check of literature sources and the Alaska Heritage Resources Survey (AHRS) files maintained by the Alaska State Historic Preservation Officer's (SHPO) office. This constitutes an "appropriate level inventory" under 43 CFR 3809. At the end of the season, a compilation of all inventories on actions would be submitted to the SHPO's office as part of a Memorandum of Understanding between BLM-Alaska and the SHPO. A paragraph describing the operator's responsibility for cultural resources would be included in both Notice and Plan letters mailed to the operators. Information on known prehistoric, paleontological, or historic resources in the area and/or cultural resources potential would be included in the case file. Most cabins and/or old mining structures and equipment are privately owned, part of the surface estate, or are not significant cultural resources. These would be generally noted or documented during on-site compliance inspections, along with references to identified paleontological or prehistoric materials.

Direct impacts would be the actual destruction of sites, structures, or materials. Indirect impacts would result from the increased accessibility of the area to people and the potential for damage to sites, structures, and materials from ORV's, hikers, and collectors.

To date, no previously undiscovered cultural resources requiring preservation or mitigation have been found in this drainage; therefore, the potential conflict between 36 CFR 800 and 43 CFR 3809 has not been raised (Section 3.8.5).

4.8.2 Alternative A

Assessment and examination for cultural resources would be conducted the same as for the Proposed Action. It is unlikely that any change in impacts to cultural resources will result. As procedures would be the same for cultural resources under the different alternatives, the difference in impacts would be addressed in site-specific environmental analyses and in frequency of monitoring. This is compatible with the RMP goals of the Birch Creek National Wild River Management Plan and the Steese National Conservation Area Record of Decision.

4.8.3 Alternative B

Assessment and examination for cultural resources would be conducted the same as for the Proposed Action and Alternative A.

4.8.4 Alternative C

Assessment and examination for cultural resources would be conducted the same as for the Proposed Action and Alternatives A and B.

4.8.5 Alternative D

There would probably be little further impact to cultural resources as a result of no mining on federal lands and it is unlikely that State and private mining would cause any change in the impacts to cultural resources. Previously undisturbed prehistoric sites and paleontological resources would remain unexposed, undamaged, and undiscovered. Historic mining sites,which are generally not protected by federal legislation, would remain largely intact although many old cabins, which are seasonally used and maintained by the miners, would be abandoned and subject to more rapid decay. Continuous natural erosion of drainages may damage and expose cultural and paleontological resources.

4.8.6 Special Considerations

Unavoidable Adverse Impacts

Since no testing and little survey would be done prior to most surface disturbing activity on mining operations, there is a possibility that cultural or paleontological resources would be impacted or destroyed without the operators' knowledge. Even if extensive testing and surveying took place, the potential for missing such resources is great due to heavy vegetation, the large areas involved, and the depth of burial for most sites. Heavy equipment can and does destroy such resources without the operator being aware of the damage. Historic mining resources, which are not generally protected by federal legislation, can and have been destroyed.

Short-Term Uses versus Long-Term Productivity

Cultural and paleontological resources would be preserved to a greater extent if no mining took place, but the knowledge gleaned from these discoveries would not exist. However, it does not seem likely that continued operation with heavy equipment would result in much further discovery due to the destructive nature of such techniques. Constant monitoring of such operations may result in better discovery and recovery, but it could also slow mining operations. The occasional new find resulting from such an effort does not seem worthwhile in view of the scarcity of resources found to date.

Unavoidable and Irreversible Commitments of Resources

Prehistoric and historic cultural resources and paleontological resources are finite and non-renewable for any particular time period. Regardless of standards set for differing alternatives, it would be the initial surface-disturbing activity that primarily impacts such resources. Such resources, once damaged, would be irretrievably lost. Not only would the material possibly be lost, but so would the scientific knowledge to be potentially gained from an undisturbed site. These resources may include structures, soil stratigraphy, bones and other fossils, pollen, and ash. The process of assessing and monitoring site-specific mining operations is the most important form of protection for these resources.

4.9 Subsistence

Subsistence uses and needs may be affected to varying degrees by a variety of causes. In general, any action which disturbs the land, its vegetative cover, the quality or quantity of water resources, wildlife or fish populations, or human or animal access routes may have an impact on subsistence uses and needs.

Such potentially impacting actions may occur all at once or gradually, so that the cumulative impact may build over time to increasingly affect subsistence. Further, cumulative impacts to subsistence uses and needs may occur strictly from human-caused events, or from naturally-caused effects, or a combination of the two. When the latter is the case, it often becomes very difficult to quantify exactly how much of the cumulative impact is human- caused versus how much is caused by nature. Moreover, agreement on exact percentage of human versus nature-caused impacts may be difficult to achieve due to the differing viewpoints or assumptions of people examining the impacts. Also of potential dispute is how much the impacts seen today are the result of recent or ongoing events versus how much they were caused by past events which, in some cases, could still be causing effects.

Placer mining is one human-caused impact in the Birch Creek drainage. In general, placer mining has the potential to impact subsistence uses and needs in the following ways:

1. Through a reduction in the potable water quality of a stream used as a source of drinking water.

2. Through disturbance or destruction of fisheries, animal populations, or habitats which support subsistence fishing, hunting, or trapping.

3. Through sedimentation of waterways which then impede human access to subsistence resources.

4. Through resulting increased harvest pressure due to the creation of more or better access routes into an area.

Other examples of human-caused potential impacts in the Birch Creek drainage include changes in hunting/trapping/fishing technology, changes in the numbers of people involved, or changes in the amount of harvest.

In the latter examples, the federal government, including BLM, may or may not have full or even any control over the impact. Also, fires may be human-caused, but their effects may be just as unpredictable as natural fires for destroying or improving wildlife habitat, populations, or causing sedimentation of streams. Further, developments may occur on private or State lands, besides federal lands, and lead to new subsistence patterns or pressures. And the type or amount of subsistence resource harvest can vary due to decisions by the State of Alaska in regulating fish and game.

Other potential human-caused impacts to the Birch Creek drainage relate to the amount of enforcement of environmental laws by responsible State or federal agencies besides the BLM (see further discussion in Chapter Two).

Finally, examples of potential nature-caused impacts to subsistence uses and needs in the Birch Creek drainage include: natural stream changes, erosion and sedimentation, and natural permafrost degradation, also resulting in sedimentation.

As noted in the subsistence section in Chapter Three, present village-based subsistence usage of Birch Creek is downstream from mining activity on BLM lands in the headwaters and is done by residents of Circle, Central, Fort Yukon, and most notably by residents of Birch Creek village. Farther downstream, toward the confluence of Birch Creek with the Yukon River, some additional subsistence usage is documented for residents of Beaver village. As shown on the Subsistence Map One in Chapter Three, overall subsistence usage of the Birch Creek drainage extends at least from the mouth of Birch Creek upstream to the area near Central. Residents of Birch Creek village, however, utilize portions of Birch Creek drainage only downriver from near the mouth of Preacher Creek. Thus, the past, current, or potential impacts to subsistence users and resources from mining are indirect to Birch Creek village, and would involve events upstream from where village-based subsistence users usually go for harvesting resources at the present time.

ANILCA 810(a) Evaluation and Finding -- General Consideration

One of the purposes of an ANILCA 810 evaluation is to identify whether subsistence uses are being significantly restricted. Under the BLM definition a "significant restriction to subsistence use" (see glossary), appears to have happened in the past, including during 1987 from mining activities or other causes. As noted in Chapter Three, decreases in the local availabilities of certain fish and wildlife have occurred while water quality generally in the Birch Creek system has been dramatically impacted by the placer mining industry. Further, there is evidence that customary riverine and lake navigational access routes in the Birch Creek drainage near Birch Creek village have been partially or totally obstructed by sedimentation coming from upriver sources including mining. The result of all this from the perspective of Birch Creek villagers is, as one resident put it, "...we can't do a lot of the things we've been doing" (Birch Creek Villagers 1987). Consequently, the conclusion would follow that a significant restriction to subsistence uses is occurring through 1987 in the Birch Creek drainage, with past and present mining involved in causing it to some greater or lesser degree.

Overall, some of the factors involved with this condition of significant restriction to subsistence uses include ones that are unlikely to totally go away in the short-term of 5-10 years. For example, sedimentation of riverine and lake areas could well remain a problem for water travel for many years into the future even if all mining ceased immediately in the Birch Creek drainage. Such cumulative impacts may be virtually permanent, from a short-term human use perspective. Also, sedimentation-related impacts on certain fish and wildlife and their habitats are unlikely to go away immediately even if all mining ended. Thus, while the forces of nature may flush out now-sedimented areas over the long-term (over 10 years), the corresponding potential recovery of fish and wildlife also would take time (see discussion under wildlife and aquatic fauna for further information). Finally, some degree of impact to potable water from Birch Creek also could linger even if all mining ceased immediately because sediments related to past mining still would be washing downstream for some unknown period of time (see discussion under Section 4.4, Water Resources).

It is in light of all these complicating factors that BLM must still do individual Section 810 (a) evaluations and findings on all alternatives presented in the EIS. Accordingly, it appears that the most reasonable approach is to focus each respective Section 810 (a) evaluation and finding for each alternative on how much, if any, new or increased contributions it would make in causing the downstream effects of:

1. Decreased fish or wildlife populations, including through increased access, if relevant,

2. Decreased terrestrial or aquatic habitat,

3. Decreased access to subsistence resources, or

4. Any other water-related impacts, such as turbidity or deterioration of the quality of potential drinking water.

ANILCA Section 810 (a): Consideration of the Availability of Other Lands and Other Alternatives.

At the end of this environmental analysis process, BLM will have analyzed all and only the lands relevant to the purposes of this study, namely the lands involved in the Birch Creek watershed. Thus, this document is considering all relevant lands so that there are no "other lands" which could be considered. This includes consideration of impacts from mining on non-federal as well as federal claims. The Proposed Action and the four alternatives discussed in this EIS constitute the "other alternatives" required for consideration by ANILCA Section 810.

4.9.1 Proposed Action

As noted under the description in Chapter Two, the Proposed Action would continue management of mining for claims on federal land as it was conducted during the summer of 1987.

Past and Projected Future Cumulative Impacts

As stated earlier, during the 1987 mining season there were significant impacts from mining on subsistence uses, particularly around Birch Creek village. Such impacts included aspects both of a cumulative and a 1987 season-specific nature. The cumulative aspects involved: 1) continuing and increasing problems of boat access to riverine and lake areas undergoing yearly sedimentation, and 2) continuing resource harvest problems due to population declines for certain fish and wildlife species related to poor water quality (see Chapter Three for discussion of each aspect). Connected more directly to the 1987 season practices was the poor quality of water found downstream from various mining operations. Yet even that, as noted earlier, is impacted in part from past mining as water naturally will pick up riverine- deposited sediments including those from past mining seasons. Thus, as stated earlier, if all mining were to cease immediately everywhere in the Birch Creek drainage, impacts to water quality, access (due to sedimentation), and fish and wildlife populations would not suddenly disappear. They would remain, although generally lessening, for several years into the future, with those related to access likely to be around the longest.

As noted, the Proposed Action would have all mining on federal claims conducted as it occurred during the 1987 mining season. This means that compliance with water quality standards would be required for those federal mines so that relatively little impact would result to Birch Creek. Also BLM would do environmental analyses to review and potentially help redesign mining operations on federal claims that might cause unintentional environmental impacts. Subsequently, field monitoring would be done by BLM on federal claims to discover any actual resulting problems. If any were found, corrective actions would be required or the mine would be shut down.

On balance, this type of management, as in 1987, would serve to substantially lessen the amount of suspended sediments coming from federal mining claim areas, but it would do absolutely nothing about potential suspended sediments entering the Birch Creek drainage from mining or eroding areas on State or private lands, nor would such management have appreciable effect on natural erosion elsewhere within the watershed. BLM has no control over one-third of the ongoing and likely future mining operations. Thus, regardless of how little suspended sediment might come off federal mining claims within Birch Creek drainage under the Proposed Action, enough is still likely to come off non-federal areas to continue causing significant restrictions to subsistence uses downstream. This is true variously if no mining were to occur on any federal claims, or if mining were to occur on all federal claims. The only difference would be that with more mines operating on federal claims, the relatively small amounts of discharged suspended sediments generally would increase correspondingly (see further analysis under Section 4.4, Water Resources). What this all means for downstream subsistence uses and resources is a continuation of the present state of a cumulative significant restriction, with non-federal sources and ongoing sediment redeposition being the more notable causes.

Another issue of concern related to subsistence is the effect of flocculants on the quality of drinking water, particularly in the vicinity of Birch Creek village. During 1987, only two operations were known to have tried adding flocculants to their settling ponds. Due to its affinity for particulates, it is unlikely that unused flocculants would be able to travel far, in stream, beyond the areas of use at mine sites. Thus, it is assumed that virtually no flocculants had the potential to enter Birch Creek in 1987 and that any apparent decreases in water quality were not due to that cause (see further discussion under Section 3.4, Water Resources).

Finally, the cumulative effects of increased access due to increased mining, additional recreationists and others likely to enter the upper Birch Creek drainage, would mean, at worst, potential resulting decreases in local animal and fish populations by increased harvest pressures, or by certain species avoiding the presence of humans. Yet, however true these theoretical effects would be in reality in upper Birch Creek, this area is relatively remote from general village-based subsistence use areas. Consequently, such potential impacts are judged unlikely to be felt in those villages to any significant extent. Related to this, it is necessary to remember that the moose population of upper Birch Creek is not the same as the one generally harvested in downstream subsistence use areas, particularly by residents of Fort Yukon and Birch Creek village. Further, if new fishing pressures were to develop in upper Birch Creek, the State of Alaska has regulatory authority and responsibility to adjust harvest levels so that stocks are not significantly reduced and that subsistence usage be given a priority over sports usage. The same is true for major animal species, such as moose.

Compliance with Section 810 (a) of ANILCA; Evaluation and Finding

1. Uses and Needs. As discussed above and elsewhere, the Proposed Action is to have mining occur on federal claims in such a way that relatively little impact would result to water quality of Birch Creek. As a consequence, mining in these federal claim areas would not itself be the major potential source for causing continuing significant cumulative impacts to subsistence uses and resources. The more significant causes would be: 1) potential impacts from non-BLM controlled mining or other erodible areas on non-federal lands, and 2) old sediments from past mining continuing to be resuspended by Birch Creek and deposited downstream. As stated before, this latter phenomenon is a cumulative impact that will continue for several years even if all mining ceased immediately in the Birch Creek drainage. In all, while the water quality downstream from mining operations on federal claims would continue to be better, as in 1987 under the Proposed Action, this still is not enough to reverse the cumulative significant impacts affecting downstream subsistence uses and resources.

2. Section 810 (a) Finding for the Proposed Action. The Proposed Action would not reverse the condition of an ongoing significant restriction to subsistence uses occurring, despite its not being the primary cause. Thus, under the Proposed Action a significant restriction to subsistence uses would still result. The direct reasons for this finding are given in the preceding sections, with supporting information found in other sections analyzing the impacts to fish, wildlife, water, and soils for this alternative.

4.9.2 Alternative A

Alternative A would be similar to the Proposed Action. The main difference is that performance standards under Alternative A for reclamation of fish and wildlife habitats, and soil and vegetation stabilization would be less restrictive than under the Proposed Action. Yet, the overall likely downstream effects on subsistence resources and users essentially would be unchanged from the Proposed Action because water quality standards would remain the same. Thus, the net effect of impacts to subsistence uses, users, and resources would be the same as under the Proposed Action. Accordingly, the impact analysis statements concerning subsistence for the Proposed Action apply to Alternative A, and should be read for further information.

Compliance with Section 810 (a) of ANILCA: Evaluation and Finding

1. **Uses and Needs.** The statements made under this heading for the Proposed Action completely apply to Alternative A because the net affects on subsistence uses and needs are the same.

2. **Section 810 (a) Finding for Alternative A.** Alternative A would not reverse the condition of an ongoing significant restriction to subsistence uses occurring despite its not being the primary cause. Thus, under Alternative A, a significant restriction to subsistence uses would still result. The direct reasons for this finding are given in the preceding sections (which refer back to the Proposed Action analyses), with supporting information found in other sections analyzing the impacts to fish and wildlife, water, and soils for this alternative.

4.9.3 Alternative B

Alternative B would be similar to the Proposed Action and Alternative A. Performance standards for water quality would remain the same, causing the same potential downstream impacts to subsistence uses, users, and resources. Reclamation standards, however, would be like the Proposed Action. As a result, the likely downstream effects of Alternative B would be particularly similar to the Proposed Action. Accordingly, the impact analysis statements concerning subsistence for the Proposed Action apply to Alternative B and should be read for further information.

Compliance with Section 810 (a) of ANILCA: Evaluation and Finding

1. **Uses and Needs.** The statements under this heading for the Proposed Action completely apply to Alternative B because the net affects on subsistence uses and needs are the same.

2. **Section 810 (a) Finding for Alternative B.** Alternative B would not reverse the condition of an ongoing significant restriction to subsistence uses occurring despite its not being the primary cause. Thus, under Alternative B, a significant restriction to subsistence uses would still result. The direct reasons for this finding are given in the preceding sections (which refer back to the Proposed Action analyses), with supporting information found in other sections analyzing the impacts to fish and wildlife, water, and soils for this alternative.

4.9.4 Alternative C

Alternative C would be different from the Proposed Action and Alternatives A and B. The main differences, as they relate to federal mining claims, are that water quality performance standards are more stringent and that restoration would be enhanced (although actual reclamation standards remain similar to those under the other alternatives). An even more dramatic difference is that the assumption made under this alternative is that all other mining in Birch Creek drainage on non-federal claims would meet the same level of water quality standards as for mining on federal claims. If this were to occur, the likely downstream negative effects on subsistence resources and users from water quality factors (including sedimentation) would lessen with each passing year. However, as explained, a significant restriction to subsistence uses would still remain in the Birch Creek drainage until the past cumulative effects of sedimentation are substantially reversed, something that would take years to occur. In other words, the trend to reverse the condition of significant restriction to subsistence uses would be established, but it would be years before it actually reversed. Thus, from a short-term (5-10 year) perspective the impacts on subsistence uses and resources are likely to be similar to those under the Proposed Action or Alternatives A or B. Therefore, once more the impact analysis statements concerning subsistence for the Proposed Action apply to Alternative C and should be read for further information.

Compliance with Section 810 (a) of ANILCA: Evaluation and Finding

1. **Uses and Needs.** The statements made under this heading for the Proposed Action completely apply to Alternative C because the finding of no net effect on subsistence uses and needs is the same.

2. **Section 810 (a) Finding for Alternative C.** Alternative C would not reverse the condition of an ongoing significant restriction to subsistence uses occurring despite its not being the primary cause. Thus, under Alternative C, a significant restriction to subsistence uses would still result. The direct reasons for this finding are given in the preceding sections (which refer back to the Proposed Action analyses), with supporting information found in other sections analyzing the impacts to fish and wildlife, water, and soils for this alternative.

4.9.5 Alternative D

As indicated under the description of this alternative, no mining would occur on federal mining claims although stabilization of surface disturbances that have occurred since 1980 would be required. Further restoration of past mined areas on federal claims would proceed only by natural causes. A significant level of mining, however, would still occur in Birch Creek drainage but only on State and private claims not under BLM jurisdiction. The net result of this for subsistence uses, users, and resources would be virtually the same as for the Proposed Action.

As for the possibility of any impacts occurring from federal mining claim areas, conceivably natural erosion during spring runoff or at other times of high water could cause some additional turbidity in Birch Creek from areas where further restoration had not take place. Still, as discussed in the water and fisheries impacts assessment sections for this alternative, the resulting downstream effects, even if this were to happen, are predicted to be negligible and temporary. They would not contribute appreciably to the accumulation of impacts otherwise to be occurring from non-federal mining or from past mining in the drainage. Otherwise, the likely downstream effects on subsistence resources and users from non-federal mining areas would be no different than under the Proposed Action. And in terms of access, potential impacts might even be less. This is because without further mining on federal claims in the future, fewer access roads would be built and presumably fewer people would enter these federal mining claim areas to potentially impact fish and wildlife or their habitats. Overall, the level of impacts would be similar to those otherwise stated for the Proposed Action. Thus, information stated there applies to Alternative D and should be read.

Compliance with Section 810 (a) of ANILCA: Evaluation and Finding

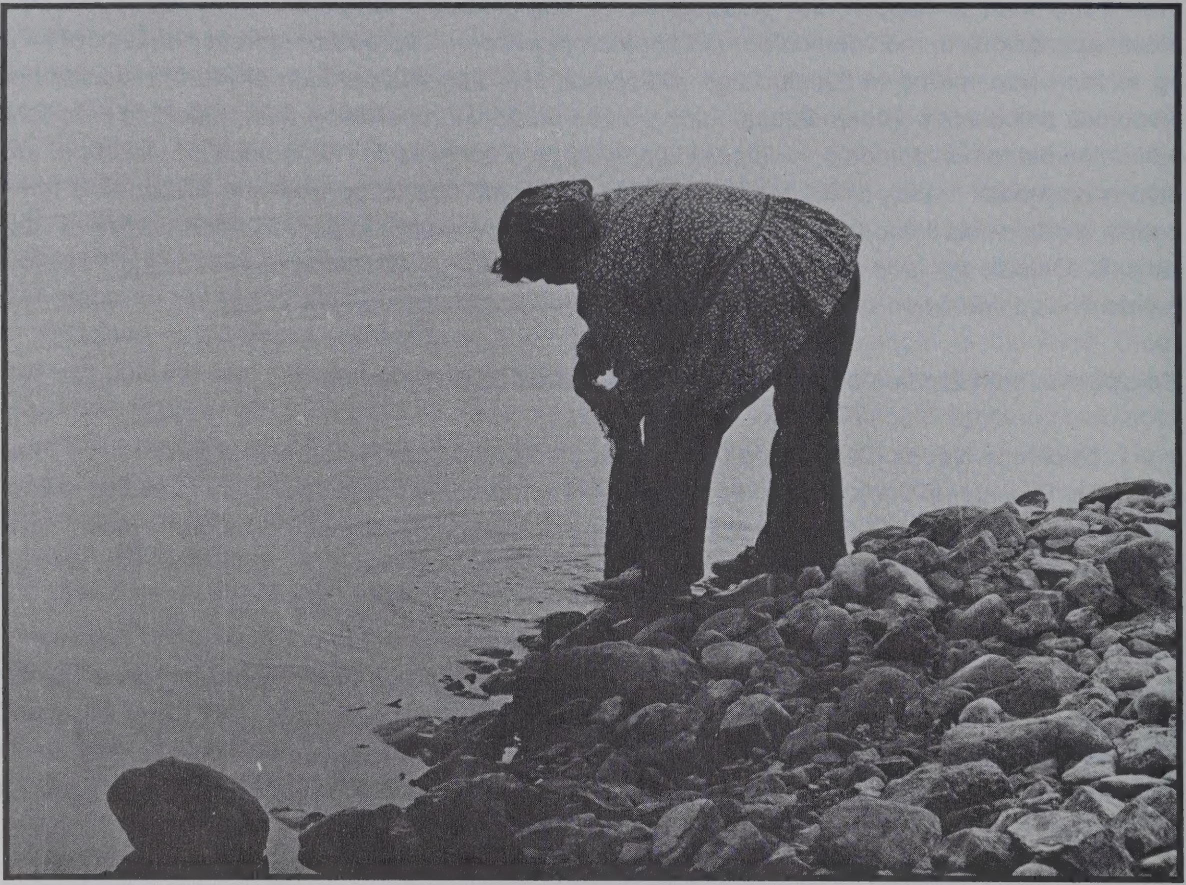
1. **Uses and Needs.** Despite the fact that no mining would occur on federal lands under Alternative D, much of the same reasoning given under this heading for the Proposed Action still applies to this alternative because the net effect is similar on subsistence uses and needs -- there would still be significant impacts.

2. **Section 810 (a) Finding for Alternative D.** Alternative D would not reverse the condition of an ongoing significant restriction to subsistence uses occurring despite its not being the primary cause. Thus, under Alternative D, a significant restriction to subsistence uses would still result. The direct reasons for this finding are given in the preceding sections (which refer back to the Proposed Action analyses), with supporting information found in other sections analyzing the impacts to fish and wildlife, water, and soils for this alternative.

Summary of ANILCA Section 810 (a) Findings

The findings for all alternatives, including the Proposed Action, were the same; namely, none would reverse the condition of an ongoing significant restriction to subsistence uses occurring in the Birch Creek drainage, although none would be significantly responsible for its continuation. Thus, under any alternative, a significant restriction to subsistence uses would still result even with no mining occurring on any federal mining claims whatsoever. This is because the predicted contribution of impacts to subsistence uses, users, and resources under all alternatives from federal claims were evaluated to be negligible in the larger equation of what is causing the ongoing significant restriction or what would cause it in the future. This conclusion was reached for each alternative because only negligible effects were predicted from any of the alternatives on animal populations, habitat, human access, or general water quality particularly in the downstream region of Birch Creek where direct subsistence usage does occur by Birch Creek village residents and others.

Finally, it should be noted that in arriving at these evaluations and findings, potential immediate, future, and cumulative impacts were considered, with the reader referred back to the respective impact analyses sections for details on each alternative.



Water is important to the subsistence lifestyle of rural Alaskans. Photo courtesy of BLM Public Affairs.

4.9.6 Special Considerations

Unavoidable Adverse Impacts

No cumulative unavoidable impacts are likely to occur under the Proposed Action or any of the alternatives to downstream areas utilized for subsistence purposes by residents of Birch Creek village or other villages. See preceding sections supporting this conclusion.

Short-Term Uses vs Long-Term Productivity

The Proposed Action and all alternatives should have no notable impacts either to cause long-term or short-term productivity changes in the availability of wild, renewable resources used for subsistence purposes by downstream residents of the region. Again, see preceding sections supporting this conclusion.

Irreversible and Irretrievable Impacts

Also, no irreversible and irretrievable impacts are likely to occur under the Proposed Action and all alternatives to downstream areas important to village-based subsistence users, for reasons again given in preceding sections.

4.10 Recreation and Visual Resources

The analysis of alternatives is best performed by separating the Birch Creek drainage into the distinct management units, each of which has specific values which must be maintained to meet the management prescriptions in the NWR and the Record of Decision for the SNCA. Appendix D-3 summarizes the BLM management units, management objectives, and standards by which these objectives are evaluated or measured.

All management prescriptions are, of course, subject to valid existing rights. In addition to these two management units which are administered by the BLM, the State of Alaska manages a portion of the Birch Creek watershed along the Steese Highway.

The degree of impact to recreation and visual resource values resulting from mining-related activities depends on the location, duration, timing, and frequency or extent of the activity.

Figure 4-4 describes the three major components and subcomponents of mineral development. The major components, access, facilities, and operations, and the listed subcomponents also will be used to assess the impacts of mineral development on the recreation and scenic values.

Appendix D-4 summarizes the potential impacts on recreation values from the various components of mining development.

The impacts to the recreation and visual resources for all alternatives are directly dependent on the impacts of placer mining to Water Resources (Section 4.4), Land Cover (Section 4.5), Wildlife (Section 4.6), and Fisheries (Section 4.7).

4.10.1 Proposed Action

Recreation Resources

The recreation opportunities and use of the area would be impacted to various degrees, and these impacts in the different portions of the watershed are measured against different management prescriptions.

North of the Wild River corridor, on federal Lands, mining is the dominant activity in many of the drainages. The objectives of the semi-primitive land use classification area are not presently attainable in drainages such as Harrison Creek, where mining activity is concentrated. Increased mining activity further detracts from the potential semi-primitive experience. The mining activities, including long-term and short-term visual intrusions to the landscape, preclude some of the areas north of the Birch Creek NWR Corridor from presently meeting the semi- primitive standard.

Anticipated impacts to fish and wildlife habitat and populations may affect the quality of hunting, fishing, and wildlife viewing opportunities. Anticipated impacts to the water resources also would directly affect the quality of the recreation opportunities which can be maintained for the public. The overall impact on the recreation values in this portion of the drainage could result in further degradation of existing values relative to the recreation management objectives.

Within the Wild River corridor, a different set of standards and objectives are in effect. Preservation of Wild River values is the dominant management emphasis. Although no mining operations or facilities exist in the Wild River corridor, the placer mining activity occurring in drainages to the north has had a long-term impact on the recreation resource values of the Birch Creek National Wild River. There appears to be a correlation between water quality and recreational visitor use of the National Wild River since 1974. Use levels have declined approximately 50% to 75% between 1974 and 1987. River recreationists, especially boaters and anglers, are apparently reacting to the water quality and recreation experience opportunities at Birch Creek by choosing to utilize areas other than Birch Creek. Under the Proposed Action, visitor use of the primitive recreation areas would continue to be at or near 1987 levels. Long-term impacts to the recreation resource would continue under this alternative, until water quality is improved.

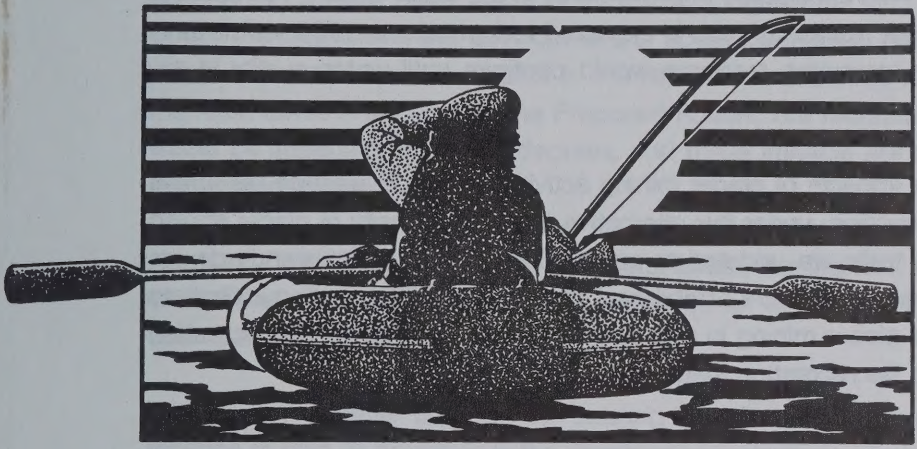
South of the Wild River corridor, the impacts of placer mining activities to the recreation resources have not been significant to date. Under the Proposed Action, the intensity of placer mining activity would continue at 1987 levels, no trails would be upgraded to roads, State water quality standards would be met at active claims, and no new summer trails would be established; hence, the semi-primitive setting would likely be maintained. The overall impact of placer mining on the recreation values of this portion of the drainage is expected to be low relative to the recreation management objectives, as stated in the ROD for the SNCA.

Under the Proposed Action, the development of additional access, facilities, and operations related to mining claims would have an impact to the recreation resources within the drainage.

Visual Resource Management

Under the Proposed Action additional access roads and mining activities would be allowed, which would create additional impacts on the visual resource. There is already an impact by those activities which have removed the vegetative cover, exposed the soil, and altered the characteristic landscape. Increased road access could facilitate greater development of the natural resources and may increase the cumulative impacts from mining. Increased access would invite new people to the area and increase recreational use of the river. Such an increase would probably require additional facilities and use supervision, and thus decrease the primitive nature of the areas, while increasing management costs. Increased road construction and mining activities would further impact water quality. Meeting water quality standards would have a positive effect on the visual resource by changing the way people perceive the landscape. Low water quality diminishes the perception of wild and natural landscape by river recreationists and others.

Long-term impacts (more than 25 years) on the visual resource would continue under the Proposed Action until mined areas are rehabilitated, the vegetative cover is restored to a natural appearing landscape, and the water quality maintained at legal standards. Within VRM Management Class III areas placer mining can take place; however, placer mining and associated activities that have taken place within this class have generally created an impact.



Rafting

Assessment and evaluation for visual resources would be conducted on a case-by-case basis, on federal claims. Individual management actions, whether proposed by the mineral claimant, or by the federal government, will undergo a visual resource assessment. Evaluating proposals on a case-by-case basis promotes effective visual resource management of the public lands. The actual visual resource impacts and mitigating measures can be determined using VRM Classes as a guideline and the "Critical Viewshed" maps as a basis for evaluating the individual and cumulative impacts in any particular viewshed of the Birch Creek watershed.

4.10.2 Alternative A

Recreation Resources

Under this alternative, the development of additional mining claim access, facilities, and operations would have an increased impact to the recreation resources within the drainage, though slightly less than the Proposed Action. The recreation opportunities and use of the area would be impacted in varying degrees, with these impacts measured against different management prescriptions.

North of the Wild River corridor, on federal lands, mining has been the dominant management activity in many of the drainages. The semi-primitive recreation experience is not presently attainable in those drainages, such as Harrison Creek, where mining activity is concentrated. Increased mining activity, and resulting facilities such as access roads, further detract from any potential semi-primitive experience. The mining activities, including long-term and short-term visual intrusions to the landscape, preclude some of the areas north of the Birch Creek NWR Corridor from presently meeting the semi-primitive standard.

Anticipated impacts to fish and wildlife habitat and populations may affect the quality of hunting, fishing, and wildlife viewing opportunities, though less so than for the Proposed Action. Anticipated impacts to the water resources also would directly affect the quality of the recreation opportunities. Improvement in the water quality would improve those recreation values related to water resources.

Within the Wild River corridor, the existing set of standards and objectives remain in effect, subject to valid existing rights. Maintenance of Wild River values is the dominant management emphasis. Although no mining operations or facilities exist in the Wild River corridor, the placer mining activity occurring in drainages to the north has had a long-term impact on the recreation resource values of the Birch Creek National Wild River. With anticipated improvements in the water quality, recreational visitor use is likely to increase. Primitive recreation use is expected to increase to 2,700 visitor days per year. Long-term impacts to the recreation resource would continue until water quality is improved.

South of the Wild River corridor, the impacts of placer mining activities to the recreation resources have not been significant to date. Assuming, under this alternative, that the intensity of placer mining activity continues at 1987 levels, no trails are updated to roads, State water quality standards are met at active claims, and no new summer trails are established, the semi- primitive setting is likely to be maintained. The overall impact of placer mining in this portion of the drainage on the recreation values is expected be low, relative to the recreation management objectives.

Visual Resources

The impacts of placer mining on the visual resources are expected to be less than the Proposed Action.

Assessment and evaluation for visual resources would be conducted on a case-by-case basis on federal claims. Individual management actions, whether proposed by the mineral claimant, or by the federal government, will undergo a visual resource assessment. Evaluating proposals on a case-by-case basis promotes effective visual resource management of the public lands. The actual visual resource impacts and mitigating measures can be determined using VRM Classes as a guideline and the "Critical Viewshed" maps as a basis for evaluating the individual and cumulative impacts in any particular viewshed of the Birch Creek watershed.

4.10.3 Alternative B

Recreation Resources

Under this alternative, the development of additional mining claim access, facilities, and operations would have an impact to the recreation resources within the drainage, though less so than for the Proposed Action. The recreation opportunities and use of the area would be impacted to various degrees, and these impacts are measured against different management prescriptions. The anticipated impacts from mining activity on the recreation resources would be essentially identical to Alternative A (Section 4.10.2).

Visual Resources

The impacts of placer mining on the visual resources are expected to be less than for the Proposed Action or Alternative A. Additional requirements would be to stabilize soils, and creek channels to facilitate natural recovery. Other than this Alternative B is the same as Alternative A.

4.10.4 Alternative C

Recreation Resources

Under this alternative, the development of additional mining claim access, facilities, and operations would have an increased impact to the recreation resources within the drainage, though less than the Alternatives A and B, and the Proposed Action. The recreation opportunities and use of the area would be impacted in varying degrees, and these impacts are measured against different management prescriptions.

North of the Wild River corridor on federal lands, the impacts would be the same as Alternative A except that the stricter water quality standards on all mining operations would improve the recreation values of the water resources.

Within the Wild River corridor, the existing set of standards and objectives remain in effect. Maintenance of Wild River values is the dominant management emphasis. Although no mining operations or facilities exist in the Wild River corridor, the placer mining activity occurring in drainages to the north has had a long-term impact on the recreation resources values of the Birch Creek National Wild River. With anticipated improvements in the water quality, recreational visitor use would increase. Primitive recreation use is expected to increase to 2,700 visitor days per year.

South of the Wild River corridor, the impacts would be the same as Alternative A.

Visual Resources

The impacts of placer mining on the visual resources are expected to be less than the Proposed Action or Alternatives A or B. Additional emphasis will be placed on restoration of mined areas. Other than this, this alternative is the same as Alternative A and B.

4.10.5 Alternative D

Recreation Resources

Under this alternative, recreation will be least impacted by mining activities, because no federal mining would be permitted.

North of the wild river corridor on federal lands, federal mining activities would cease. Mining operations on State claims and private lands would continue. Some impacts would continue from federal mining areas because of tailings, existing roads, and disturbed areas undergoing reclamation. State and private mining would continue, and there would be no reclamation on these lands. Therefore, the semi-primitive recreation experience may not be attainable in some drainages.

Within the Wild River corridor it is anticipated that with the cessation of federal operations the water quality would improve, and the recreation visitor use would likely begin to increase. Long-term impacts to the recreation resource would decrease somewhat under this alternative.

South of the Wild River corridor, the impacts of placer mining activities to the recreation resources have been minimal. The overall impact of placer mining on the recreation values within this portion of the drainage on the recreation values is expected to be extremely low relative to the recreation management objectives.

Visual Resources

Some impacts of federal placer mining on the visual resources are expected, but would be greatly reduced because of reclamation. Impacts would continue on State and private lands. By ending all mining activity on federal lands, the introduction of new visual intrusions would also be stopped. Some visual impacts from past mining, may however, remain as long-term impacts.

4.10.6 Special Considerations

Unavoidable Adverse Impacts

The cumulative impacts of mineral development in the Birch Creek watershed on the recreation and visual resources is directly dependent on the cumulative impacts expressed in Water Resources, Wildlife, Fisheries, and Land Cover (See appropriate sections). These resources are integral components of the recreation opportunities provided, as well as the quality of the recreation activity experienced. The recreation management prescriptions are directly related to these resource values.

Unavoidable short-term impacts occur from mineral development. Visitors to the Birch Creek watershed in areas adjacent to mineral access routes, facilities, or operations would not experience primitive or semi-primitive recreation opportunities. Visitors seeking hunting, fishing, or wildlife viewing may also have somewhat less of a "primitive" recreation experience where concentrations of mining operations occur. Federal, State, and private mining operations contribute to the turbidity of Birch Creek NWR and adversely affect visitors seeking a primitive setting.

The potential shift of the type of use on Birch Creek National Wild River from a primitive to a less primitive setting would be an unavoidable long-term impact. As claims are developed south of Birch Creek NWR, additional demands to improve access routes across Birch Creek would adversely affect Wild River values.

Short-term Use vs Long-Term Productivity

It is expected that the short-term use of resources for active placer mining would compromise certain recreation values, such as primitive areas. At the same time, long-term productivity may continue to be affected by placer operations if adequate and appropriate reclamation is not undertaken and implemented. Roads will continue to constitute a long-term impact, because they traditionally remain in use and are not reclaimed, with concomitant impacts on other recreational and visual values.

Irreversible and Irretrievable Commitment of Resources

Within the Wild River corridor, there has probably been no irreversible and irretrievable commitment of resources. Placer mining and associated activities do constitute an irreversible and irretrievable commitment of certain resources. With appropriate reclamation, enforcement of applicable State and federal statutes and standards, and appropriate mitigation measures, recreation and visual values need not be irreversibly committed beyond the present situation.

4.11 Economics

Economic impacts related to recreation are described in the previous section.

4.11.1 Proposed Action

With a continuation of present management, it is assumed that the total number of mines within the watershed would increase from 65 to 80 (23%) over the next decade. If so, it is reasonable to also assume that mining expenditures, total output, mining employment, total employment, mining income, and total income would also increase by about 23%.

Local population in and around Central and Circle Hot Springs would be expected to increase by 40 to 45 people, assuming that 21% of the additional miners would reside within the drainage or in nearby communities, and the population would increase by three individuals for each additional miner.

Economic impacts are displayed in Figure 4-8.

4.11.2 Alternative A

With Alternative A, it is assumed that the total number of mines within the watershed would increase from 65 to 70 (8%) over the next decade (see Appendix B-2). If so, it is reasonable to also assume that mining expenditures, total output, mining employment, total employment, mining income and total income would also increase by about 8%.

	1985 level	Proposed action	Alternatives A & B	Alternative C	Alternative D
Total Number of Mines	65	80	70	58	32
Percentage change from 1985		+23%	+8%	-11%	-51%
MINING EXPENDITURES[1]					
Local	$786,000	$967,000	$849,000	$700,000	$385,000
Fairbanks	$6,995,000	$6,604,000	$7,555,000	$6,226,000	$3,428,000
Alaska	$7,913,000	$10,287,000	$8,546,000	$7,043,000	$3,877,000
TOTAL OUTPUT[2]					
Fairbanks	$11,961,000	$14,712,000	$12,918,000	$10,645,000	$5,861,000
Alaska	$15,906,000	$19,564,000	$17,178,000	$14,156,000	$7,794,000
MINING EMPLOYMENT (FTE)					
Local (within the drainage)[3]	289	355	312	257	142
Alaska[4]	1,678	2,064	1,812	1,493	822
TOTAL EMPLOYMENT[5] **(FTE)**					
Fairbanks	162	199	175	144	79
Alaska	236	290	255	210	116
MINING INCOME[1]					
Local	$374,000	$460,000	$404,000	$333,000	$183,000
Fairbanks	$870,000	$1,070,000	$940,000	$774,000	$426,000
Alaska	$1,218,000	$1,498,000	$1,315,000	$1,084,000	$597,000
TOTAL INCOME[6]					
Local	$950,000	$1,169,000	$1,026,000	$846,000	$466,000
Fairbanks	$1,862,000	$2,290,000	$2,011,000	$1,657,000	$912,000
Alaska	$3,094,000	$3,806,000	$3,341,000	$2,754,000	$1,516,000

[1] Birch Creek Mining Expenditures taken from Hagler, Bailey & Co. 1987, Table 4.

[2] Taken from Hagler, Bailey & Co. 1987, Table 5.

[3] Taken from Hagler, Bailey & Co. 1987, pg. 3.13.

[4] Taken from "The Role of Placer Mining in the Alaska Economy 1985," Dept. of Commerce & Economic Development - Office of Mineral Development 1986.

[5] Direct plus indirect employment generated by mining in the Birch Creek drainage - taken from Hagler, Bailey & Co., 1987, Table 5.

[6] Total Income = Expenditures X appropriate income multiplier from Chap. 3.

Figure 4-8. Birch Creek Economic Impacts. FTE means Full Time Equivalent.

Local population in and around Central and Circle Hot Springs would be expected to increase by 10 to 15 people, assuming that 21% of the additional miners would reside within the drainage or in nearby communities, and the population would increase by three individuals for each additional miner.

4.11.3 Alternative B

This alternative is the same as Alternative A.

4.11.4 Alternative C

With Alternative C, it is assumed that the total number of mines within the watershed would decrease from 65 to 58 (11%) over the next decade (see Appendix B-2). If so, it is reasonable to also assume that mining expenditures, total output, mining employment, total employment, mining income, and total income would also decrease by about 11%. This would cause an unavoidable adverse economic impact that would be most apparent in the communities of Central and Circle Hot Springs. Total employment and income would change by less than 1% from the 1985 levels for the Fairbanks North Star Borough.

Local population in and around Central and Circle Hot Springs would be expected to decrease by about 20 people, assuming that 21% of the miners would reside within the drainage or in nearby communities, and the population would decrease by three individuals for each miner that leaves the area.

4.11.5 Alternative D

With Alternative D, it is assumed that the total number of mines within the watershed would decrease from 65 to 32 (51%) over the next decade (see Appendix B-2). If so, it is reasonable to also assume that mining expenditures, total output, mining employment, total employment, mining income, and total income would also decrease by about 51%. This too would cause an unavoidable adverse economic impact that would be most apparent in the communities of Central and Circle Hot Springs. Under this alternative total employment and income within the Fairbanks North Star Borough would change by less than 1% from the 1985 level.

Local population in and around Central and Circle Hot Springs would be expected to decrease by 90 to 100 people, assuming that 21% of the miners would reside within the drainage or in nearby communities, and the population would decrease by three individuals for each miner that leaves the area.

4.12 Mitigation

Mitigation measures are generalized prescribed actions which can be taken to reduce or eliminate the impact of placer mining on various resources in the Birch Creek watershed.

Guidelines for development of measures to mitigate impacts to resources included prioritization of the types of mitigation. The highest priority is to avoid the impact, a lesser priority is to minimize or rectify the impacts, and the last priority was to replace the impacted resource. On-site or in-basin mitigation within the stream or drainage where the impact occurred is favored, as was "in-kind" mitigation, where the impacted resources would be replaced, thereby reducing both potential disruptions to the system's ecology and management problems. Some impacts cannot be mitigated and are an irreversible or irretrievable impact to the resource.

When specific mineral development actions are proposed in the area, a site-specific analysis of effects will be developed through the environmental assessment process for each Plan of Operations, as required by the NEPA and 43 CFR 3809. As a result of this process, stipulations which alter or restrict timing, location, and extent of a mineral development activity may be required to avoid or minimize adverse effects and to avoid unnecessary or undue degradation. Various mitigation measures are discussed extensively in "Surface Disturbing Activities in Alaska: A Guide to the Technical Aspects of Mitigation and Reclamation" (DOI 1987d) and shown in Figure 4-9. Recommended mitigation measures and accompanying rationale for wildlife are in Appendix D-2.

The alternatives are a gradient of mitigation measures, with emphasis on water quality and reclamation standards (Section 2.3). The effectiveness of the mitigation measures will vary considerably with the site conditions of each mining operation.

The varying degrees and effectiveness of the reclamation efforts required by the Proposed Action and each alternative have been incorporated into the analysis and are discussed in their respective sections.

Quantitative estimates for changes in impacts for specific alternatives and locations cannot be made due to the variation of other site-specific environmental conditions. However, the trends of the mitigation will be to decrease each identified impact.

In order to provide an appropriate level of mitigation for any impact, the extent and magnitude of the impact effects on the resource must be known. In some cases, impacts cannot be precisely estimated due to their complexity, the lack of information, or the low probability of their occurrence. Additional information is then required to develop suitable mitigation. In those instances, the potential impacts must be measured through an impact monitoring program designed to detect changes in biological and/or physical parameters.

The timing and location of unpredictable impacts, such as a hazardous material spill, are unknown, so a monitoring program is not feasible. However, implementation of a pre-determined mitigation response plan to contain, neutralize, and clean up the impacted area is possible. A follow-up assessment of biological impact, reclamation, and replacement could then be implemented.

Resource component	Impact	Mitigation under the alternatives	Further mitigation not covered under the alternatives	Irreversible and irretrievable commitments of resources
Topography	Localized modification of landscape	Reshape and stabilize during reclamation		
Mineral resources	Increased costs of compliance and less development	Lower water quality and reclamation standards		
Soils	Destruction of soil structure			X
	Loss of fine–grained soils through erosion	–Reshape to reduce slope angles –Revegetate to reduce rate of water runoff		
	Compaction in areas of roads and trails		Access allowed only during winter when ground is frozen and adequate snow cover exists	
Water resources	Greater stream channel gradient and reduced sinuosity	–Resestablish stream in original floodplain –Rebuild channel to approximate original channel		
	Increased sediment levels and turbidity during operations in stream	Use mining techniques to meet water quality standards for sediment and turbidity, including settling ponds, recycling and stream bypasses		
	Accelerated erosion from non–point sources	Revegetate and reshape		
	Erosion from roads		Careful design and construction will alleviate some	Some
Landcover	Reduced productivity shortly after mining	Reseeding and fertilization	Scarify, mulch	Some
	Loss of original riparian vegetation with organic soils			X
	Loss of fine–grained material in soils	–Reshape topsoil and overburden –Respread tailings and pond fines		
	Change of vegetation species, pattern and structure		–Leave strips of orginal vegetation as seed source –Redistribute topsoil in patchy pattern	Some
	Areas will remain barren or sparsely vegetated		–Replant with willow shoots	Some
	Loss of vegetation from roads Change of vegetation type from trails		Winter travel in non–forested areas, especially wetlands	Some

Figure 4-9. Mitigation for impacts from placer mining.

Continuation

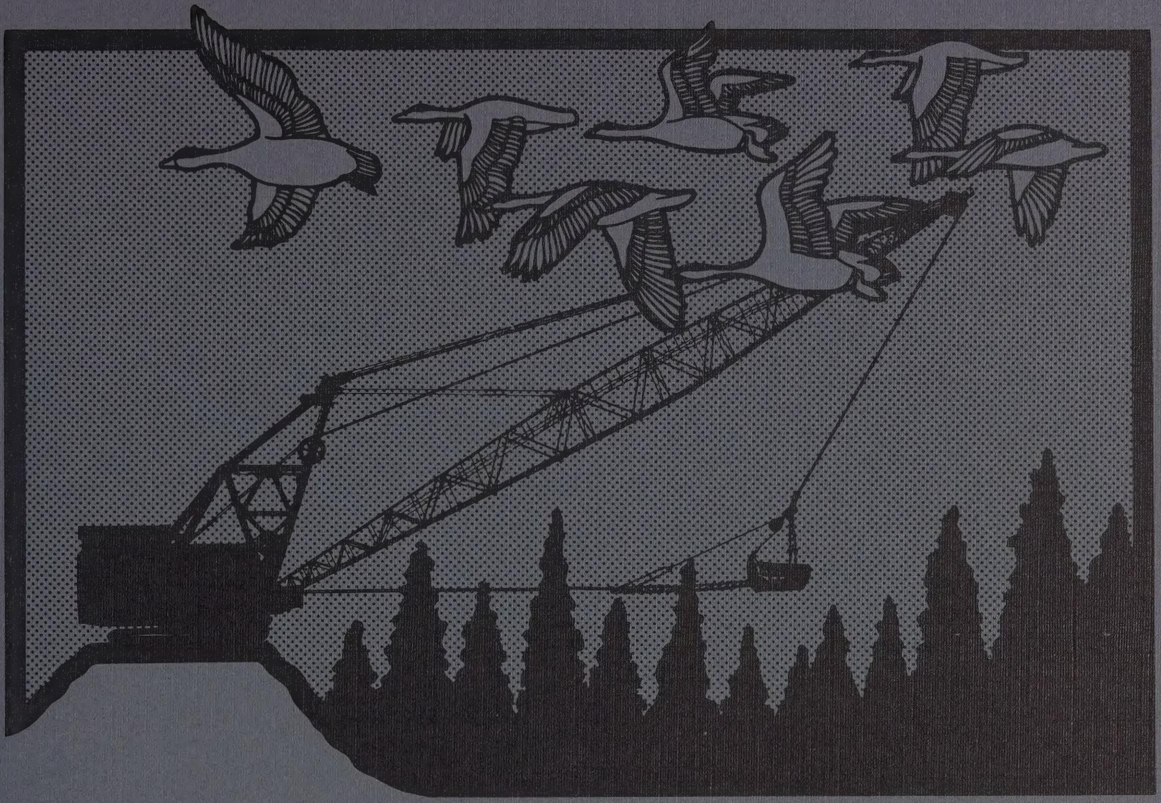
Resource component	Impact	Mitigation under the alternatives	Further mitigation not covered under the alternatives	Irreversible and irretrievable commitments of resources
Wildlife	General habitat loss	Reseeding and fertilizing	Reclaim lost habitat–see Landcover	Some
	Crucial habitat loss		Locate development to avoid crucial habitats	
	Disturbance/ disruption of wildlife use pattern		Restrict or alter timing of operations, location, and extent of activities	Some
	Increased hunting pressure due to roads and trails		–Regulation by other agencies –Restrict access	Some
	Hazardous material spills		Plan to contain, neutralize,and clean up. Locate fuel operations and storage away from streams, storage areas diked and lined with impermeable material	
	Removal of nuisance animals		Dispose garbage and other waste so as to not attract animals	
Aquatic fauna	Loss of fish habitat Decreased populations	Restore creek channel in floodplain with original gradient, contours, pools, riffles, etc.		
	Short–term loss of productivity			X
	Restriction of fish passage through channel		Construct culverts to ensure passage	
	Increased flow rate Low water especially in winter Loss of pools Silt and sedimentation from erosion	–Stabilize and reconfigure –Regrowth of vegetation		
	Loss of food and light penetration from siltation	Water quality standards		
	Loss of riparian cover		–Buffers of at least 100 feet around streams where physical alterations are permitted, except on mining claims –Replant with willow shoots	In some areas of mining claims
Cultural resources	Possible harm to undiscovered artifacts	Review cultural information, site inspection if cultural resource located during mining operations		
Subsistence	Impacts to natural system	See Other Resources		
	Changes in human technology and use patterns			Yes, unless regulations established

Figure 4-9 continued.

Continuation

Resource component	Impact	Mitigation under the alternatives	Further mitigation not covered under the alternatives	Irreversible and irretrievable commitments of resources
Recreation	Decrease primitive experience Increased access creating pressure, especially in primitive areas	Follow RMP for access development, i.e. no construction of roads in primitive areas	Remove or clean up old camps and facilities	
	Reduced wildlife viewing and hunting		See Wildlife	Some
Visual	Reduced visual quality and visual modifications from development and its effects	—Water quality requirements —Reconfigure tailings to approximate surrounding contours —Revegetation	Remove garbage, use natural appearing materials for buildings, etc.	Some
Economics	Reduced employment in mining and secondary industries resulting from increased compliance costs	—Gradient of water quality and reclamation standards		Some

Figure 4-9 continued.



BIRCH CREEK

Chapter V
Public Participation

Section | Page

5.1 Introduction....5 – 1
5.2 Scoping and Issue Identification....5 – 1
5.3 Names and Qualifications of Preparers....5 – 3
5.4 List of Persons, Organizations, and Agencies Reviewing the EIS's....5 – 5

5.1 Introduction

This chapter consists of three parts: **Part One** describes the consultation and coordination process.

Part Two contains the names and qualifications of the persons responsible for preparing these EISs.

Part Three is a list of persons, organizations, and agencies reviewing the EISs.

This chapter is being prepared in the same manner for each of the EISs for the four watersheds of concern (Section 1.2). Public interest was focused on all the drainages, with some limited, specific references to each particular drainage. In some cases, data were collected on an area-wide basis. The preparers worked on all four of the documents, some to different extents.

5.2 Scoping and Issue Identification

5.2.1 Introduction

The BLM conducted a broad public and interagency consultation program throughout the development of this project, and this input has been incorporated into this document. Specific public and agency involvement is described below.

5.2.2 Scoping

The scoping process conducted by the BLM provided an opportunity for members of the public, special interest groups, the mining industry, and other agencies to assist in defining significant environmental issues. The main objectives of the scoping meetings were:

- To present an overview of this EIS.
- To identify the major environmental issues to be addressed in this EIS.
- To receive comments and questions regarding environmental impact concerns.
- To incorporate those comments and questions into the EIS planning process.

Initially more than 450 letters were sent to the public requesting comments, issues, and concerns to help in setting the parameters of the study, and developing a mailing list.

The scoping process was initiated for this EIS with the publication of a Notice of Intent to prepare an EIS in the Federal Register of August 18, 1987. The scoping meetings were also announced in local papers and on radio throughout the Fairbanks area, in remote communities, and in Anchorage. These announcements resulted in formal meetings in the following locations, which were attended by various publics and agencies.

The scoping meetings and the approximate number of persons in attendance were as follows:

Date	**Location**	**Attendance**
Sept. 9, 1987	Central	44
Sept. 10, 1987	Livengood	34
Sept. 15, 1987	Chicken	33
Sept. 16, 1987	Fairbanks	51
Sept. 17, 1987	Anchorage	20
Oct. 5, 1987	Minto	31
Oct. 6, 1987	Birch Creek Village	10

Additionally, a total of 32 written comments were received. These and the oral comments taken at the meetings were summarized and reviewed by EIS team members. This review was to respond to the issues and concerns, and to provide a systematic procedure for EIS preparation. The issues and concerns were organized into general areas of concern for further evaluations.

Copies of these comments, as well as tapes of scoping meetings for review are available in the BLM State Office in Anchorage. The general areas of concern cited in public response letters are subsistence, NEPA, reclamation, recreation, water quality, sedimentation, fish and wildlife, habitat, economics, legal considerations, research, and engineering. All concerns identified during the scoping process were carefully considered during the development of this EIS.

The National Park Service (NPS) is conducting a cumulative EIS similar to the BLM effort. Several meetings were held to exchange information and ideas. The NPS and the BLM approached the issues of a cumulative EIS in a somewhat different manner due to their different management responsibilities.

The Corps of Engineers (COE) is cooperating with the BLM in these EISs. There has been useful exchange of information between the two organizations.

The U.S. Fish and Wildlife Service was solicited for information regarding any listed and proposed threatened and endangered species that may be present in the Beaver Creek drainage. Informal consultation determined that no candidate endangered, or threatened species would be effected.

Meetings were held with the EPA during the scoping and data collection process. In particular, EPA was concerned that this EIS not become involved with the present reevaluation of proposed placer mining regulations. Several meetings were held to deal with technical aspects of water quality; these produced information to refine the water quality efforts and this led to several contracts with State agencies to assist BLM in data acquisition and analysis.

Meetings and briefings were conducted with the State of Alaska, including the Departments of Fish and Game, Environmental Conservation, Natural Resources, and Office of Management and Budget.

In addition to numerous meetings to gather data on resources and programs, the State of Alaska collected data and provided interpretation in several contractual reports. These reports included the topics of water quality, aquatic habitat and fisheries, biologic information, and a review of other consultant reports.

Meetings were conducted with the U.S. Bureau of Mines, State of Alaska Department of Natural Resources, and the U.S. Geological Survey to update the BLM on mineral resources and geology in the study area.

5.3 Names and Qualifications of Preparers.

Carol Belenski, Visual Information Specialist for seven years, with a total of 11 years with BLM. Mapping specialist and printing coordinator for numerous plans.

Kent F. Biddulph, Landscape Architect/Environmental Planner, Bachelor of Arts, 1964, Utah State University. Twenty-one years in Landscape Architecture/Visual Resource Management and Recreation Planning.

Frank Bruno, Writer/Editor, Bachelor of Arts - Journalism, 1974, San Jose State University. Five years with BLM.

Louis Carufel, District Fisheries Biologist, Bachelor of Science - Biology, 1948, St. John's University - Minnesota; Master of Science - Fish and Wildlife Management, 1960, Montana State University. Twenty years of Federal service.

Lee Douthit, Subsistence Coordinator, Bachelor of Arts - History, 1967, Texas Woman's University; Master of Arts - Anthropology, 1976, University of Texas at Austin; Ph.D. - Anthropology, 1978, University of Texas at Austin. Seven years with BLM as a Research Archaeologist, cultural resource manager, and subsistence coordinator.

Linda Du Lac, Land Law Examiner, Bachelor of Science - Resource and Recreation Management, 1974, Oregon State University. Nine years with the Forest Service and four years with BLM.

Bruce Durtsche, District Wildlife Biologist, Bachelor of Science - Wildlife Biology, 1978, Arizona State University. Twelve years with BLM. Three years with the State of Arizona.

Richard F. Dworsky, Project Manager, Bachelor of Science - Forestry, 1965, University of Michigan; Master of Science - Recreation, 1972, Colorado State University; Ph.D. - Forestry, 1986, University of Massachusetts. 20 years in natural resources planning and management. Former Chief of Forestry in Puerto Rico.

KJ Ferencak, Land Law Examiner, Associate Degree - Mining Engineering, 1981, Penn State University. Five years with BLM.

William S. Hauser, Mining Engineer, Bachelor of Science - Mining Engineering, 1977, Virginia Polytechnic Institute and State University. 10 years federal service.

Ronald G. Huntsinger, Physical Scientist, Bachelor of Arts - Biology, 1972, Humboldt State University; Graduate studies - Hydraulic Engineering and Watershed Management, Humboldt State University. Fifteen years experience in hydrology, watershed management, aquatic sciences, and undergraduate instruction in biology and physics.

Robert E. King, Anthropologist, Bachelor of Arts - History, 1970, Washington State University; Bachelor of Arts - Anthropology/Archaeology, 1970, Washington State University; Master of Arts - Anthropology/Historical Archaeology, 1973, University of Pennsylvania; Ph.D. - Anthropology/Ethnohistory, 1978, University of Pennsylvania. Six years with BLM. One year Anthropology contract work. Two years author, historian.

Paula V. Krebs, Geographic Information Systems Coordinator, Bachelor of Arts - Zoology, 1965, University of Colorado; Ph.D. - Plant Ecology, 1972, University of Colorado. 22 years experience in landcover/vegetation data production, applied plant ecology projects, ecological analysis and vegetative mapping, and graduate/undergraduate instruction in Botany and Resource Management.

Howard Levine, Land Law Examiner, Bachelor of Arts - Geography, 1981, San Diego State University. Seven years with BLM.

Thomas C. Mowatt, Geologist, Bachelor of Arts, 1959, Rutgers University; Ph.D., 1965, University of Montana. Twenty-five years professional experience in geology, geochemistry, chemistry, and environmental sciences, including private sector research and energy/mineral resources exploration/development/production, university teaching and research, state and federal government work. Active professionally in Alaska since 1970.

Kim Pearce, Illustrator, Bachelor of Science, major - Illustration, minor - Biology, 1986. Nazareth College of Rochester, New York. One year with BLM.

Jacob Schlapfer, Land Use Planner, Bachelor of Science - Biology, 1987, Western Oregon State College. One year with the U.S. Forest Service. Two years with the U.S. Fish and Wildlife Service.

Page Spencer, Technical Coordinator, Bachelor of Science - Biology, 1972, University of Alaska - Fairbanks; Master of Arts - Ecology, 1975, University of Colorado; Ph.D. - Plant Ecology, 1981, University of Alaska, Fairbanks. Seven years with BLM.

John Thompson, Environmental Coordinator, Bachelor of Science - Economics and Political Science, 1975, Dakota State University; Master of Science - Agricultural Economics, 1977, Purdue University. Employed by BLM 1977 to present.

Dave Vogler, Hydrologist, Bachelor of Science - Watershed Science (Hydrology), 1978, Colorado State University. Ten years subsequent professional experience in hydrology.

Susan M. Will, Archaeologist, Steese-White Mountains District, Bachelor of Arts, 1975, University of Alaska at Fairbanks. Nine years with BLM.

Support Personnel

Mike Clark, Cartograhic Technician

Debbie Llacuna, Clerk/Typist

Linda Mowatt, Miscellaneous Documents Clerk

Betty Ostby, Land Law Assistant

Aaron Ritchins, Cartographic Technician

Paul Schepler, Clerk/Typist

5.4 List of Persons, Organizations, and Agencies Reviewing the EISs.

Alaska Congressional Delegation

Don Young
Frank Murkowski
Ted Stevens

Alaska State Government

Alaska Dept. of Commerce and Economic Development
Alaska Dept. of Environmental Conservation
Alaska Dept. of Law
Alaska Dept. of Natural Resources

Alaska Governor's Office
Alaska Dept. of Policy Development and Planning
Governor, State of Alaska
Honorable John B. Coghill
University of Alaska - Anchorage Library
University of Alaska

U.S. Government

National Park Service
U.S. Bureau of Land Management
U.S. Corps of Engineers
U.S. Environmental Protection Agency
U.S. Fish & Wildlife Service

Organizations

Alaska Center for the Environment
Alaska Federation of Natives
Alaska Miners Association
Alaska Women in Mining
Birch Creek Council
Circle District Historical
Citizen's Adv. Commission on Federal Areas
Denali Citizens Council
Klondike Placer Miners Association
Northern Alaska Environmental Center
Sierra Club
The Wilderness Society
Trustees for Alaska

Businesses

Alaska Gold Company
Alloy Welding & Machine
Alyeska Oil & Exploration
Anchorage District Recording Office
Apocalypse Design, Inc.
Bean Ridge Corporation
Beaver Kwit'chin Corporation
Clem's Backpacking Sports
Danzhit Hanlaii Corporation
Dinyee
Dot Lake Native Corporation
Doyon, Limited

Environlab
Fairbanks District Recording Office
Fairbanks Exploration
Fraley Equipment, Inc.
George Miller Construction, Inc.
Hungwitchin Corporation
Kachemak Mining Company
Little Squaw Gold Mining Company
Nerco Minerals Company
Ray Wolf Mining
Rife & McMillan
Robertson Mining Company
Russell/Norton/Drovin
Seth-de-ya-ha Corporation
T.C.C.
Tanacross, Inc.
Tihteet'Aii, Inc.
Tozitna, Limited
Usibelli Coal Mine, Inc.
Yukon Quest International, Ltd.

Libraries & Newspapers

Noel Wien Library
Alaska Resources Library
Z.J. Loussac Public Library

375 Individuals

BIRCH CREEK

Appendices

Section		Page
A – 1	Summary of Contractor Reports	A – 1
A – 2	Placer Mining Permit Process	A – 3
B – 1	Methodology for Forecasting the Future Number of Mines and Roads, and Acres of Reclamation and Disturbance	A – 4
B – 2	Assumptions for Worst Case Scenario	A – 5
B – 3	Methodology for Estimating Cost of BLM's Surface Management Program and the Cost for Implementing Alternative D for the Birch Creek Drainage	A – 6
B – 4	Economic Worst – Case Scenario	A – 8
C – 1	Geologic Time Scale	A – 9
C – 2	Recreation Methodology	A – 9
D – 1	Landcover Methodology	A – 11
D – 2	Recommended Mitigation Measures for Wildlife	A – 12
D – 3	BLM Management Units, Objectives and Standards	A – 16
D – 4	Potential Impacts on Recreation Values	A – 17
E – 1	Methodology for Sediment	A – 18
E – 2	Staking and Operating a Federal Mining Claim	A – 19
E – 3	Comparison of Reclamation Requirements and Estimated Costs	A – 21
F – 1	Regulatory Program of the U.S. Army Corps of Engineers, Alaska District	A – 21

Appendices

Appendix A-1, Summary of Contractor Reports

1. Alaska Division of Geological and Geophysical Surveys (DGGS)

A cooperative agreement was entered into between the Bureau of Land Management (BLM) and the Alaska Division of Geological and Geophysical Surveys. The agreement provided additional funds and logistical support to DGGS for it to collect and analyze stream discharge, water quality, and biological information, and to carry out synthesis work, during 1987. The agreement called for DGGS to attempt to evaluate the cumulative environmental effects of placer mining in the Birch Creek, Beaver Creek, and Fortymile River drainages. In addition, DGGS would also attempt to assess the cumulative impacts of mining on subsistence activities in the Birch Creek and Minto Flats watersheds.

Two reports were produced by DGGS, "Water quality and discharge data from selected sites in the Fortymile and Tolovana Drainages, Summer 1987," written by Stephen F. Mack, Mary A. Moorman, and Linda Harris (ADGGS 1987), and "Compilation of Stream macroinvertebrate data for the Birch Creek, Beaver Creek, Fortymile, and Minto Flats drainages, Alaska," written by Mary A. Maurer (1987). Additional data was supplied to the BLM on computer diskettes for stream discharge in the Tolovana and Fortymile drainages by Steve Mack and John Bauer, the latter from the Alaska Department of Environmental Conservation. BLM receipt of these products is considered to constitute completion of the project.

2. Alaska Department of Fish and Game (ADF&G)

The Alaska Department of Fish and Game Habitat Division was contracted to prepare a report for the BLM on the aquatic habitat for all watersheds addressed in Sierra Club v. Penfold. The contract also called for ADF&G to provide the BLM with extant data on computer disks in the Lotus 123 format regarding hydrogeology, water quality, and geochemistry in the four watersheds of concern.

A final report entitled "Aquatic habitat and fisheries for seven drainages affected by placer mining: Chatanika River, Tolovana River, Goldstream Creek, Birch Creek, Fortymile River, Beaver Creek, Minto Flats," was filed with the BLM in December, 1987 (ADF&G 1987b).

3. Hagler, Bailly, and Company

Hagler, Bailly, and Company of Washington, D.C. was contracted to prepare an analysis of the economic and historical relationship of placer mining in Interior Alaska. The Hagler, Bailly study addressed the history of placer mining in the four watersheds, current status of the industry and its socio-economic impacts, and a projection of levels of future mining activity based on the results of research, synthesis, and interpretations of extant information. Hagler, Bailly, and Company subcontracted substantial portions of the study to L.A. Peterson and Associates of Fairbanks, Alaska. This work was facilitated, administered, and funded by BLM-Washington Office (680).

A draft report was sent to the BLM in December, 1987 (Hagler, Bailly and Company 1987).

4. Environmental Services, Ltd. (ESL)

Environmental Services, Ltd. provided a "Model Environmental Assessment (EA)" upon which the BLM could base the preparation of EAs for each placer mining operation starting in 1988 as directed by order of the District Court in the Sierra Club lawsuit. A draft report was submitted to the BLM in December, 1987, followed by a final report in January, 1988 (ESL 1987).

A second contract was entered into with ESL to provide BLM with data on wildlife for all four drainages. This report was provided to the BLM in January, 1988.

5. Arctic Hydrologic Consultants (AHC)

AHC was contracted by BLM to assess differences in water parameters between mined and unmined areas of Beaver Creek, Birch Creek, Fortymile River, and the drainages into Minto Flats (Chatanika River, Tolovana River, and Goldstream Creek.) AHC was also to provide a comparison of water quality values in mined areas with State and federal water quality regulations, as they apply to receiving water. In addition, AHC was to evaluate the state of the technology available for controlling wastewater quality at placer mining operations.

A final report dealing with Birch and Beaver Creeks and the Tolovana River was delivered to the BLM on February 29, 1988 (AHC 1988).

6. Peter E. K. Shepherd

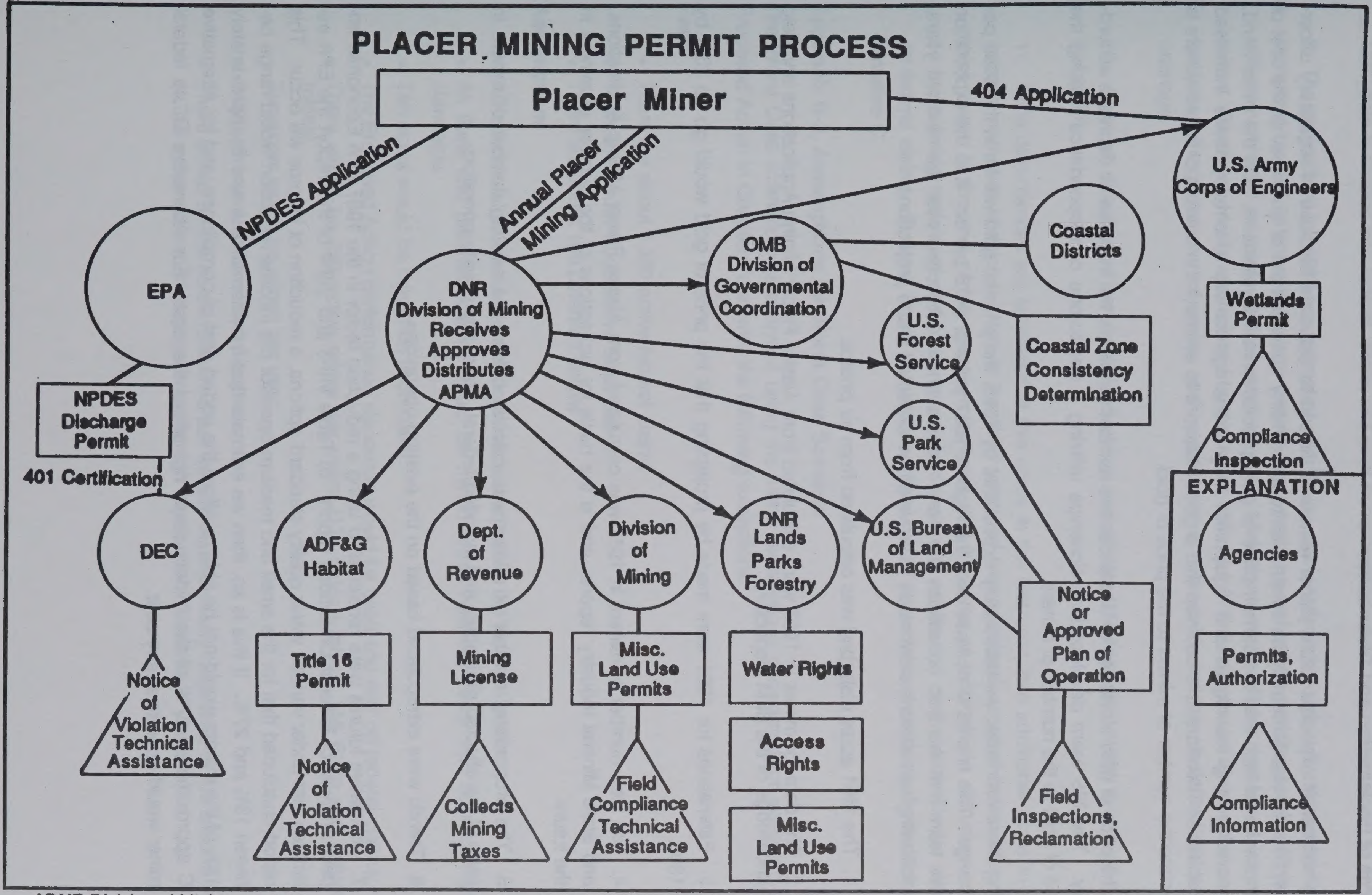
Mr. Shepherd prepared a report entitled "Impacts of Environmental Change on Minto Flats Subsistence Resources" (Shepherd 1987). The report examined the effects of placer mining on environmental habitats within the Minto Flats watershed and the relationship of those effects to subsistence uses and needs.

A final report was submitted to the BLM in January, 1988.

7. Dames and Moore

Dames and Moore was contracted to supply a report assessing the cumulative impacts of placer mining on the aquatic communities of the four watersheds. Additionally, Dames and Moore was to provide an assessment of the impact of placer mining within each stream basin on the aquatic communities of the receiving waters. A final report was sent to BLM in February, 1988 (Dames and Moore 1988).

Appendix A-2, Placer Mining Permit Process


PLACER MINING PERMIT PROCESS
Placer Miner
NPDES Application
Annual Placer Mining Application
404 Application
EPA
NPDES Discharge Permit
401 Certification
DEC
Notice of Violation Technical Assistance
DNR Division of Mining Receives Approves Distributes APMA
ADF&G Habitat
Title 16 Permit
Notice of Violation Technical Assistance
Dept. of Revenue
Mining License
Collects Mining Taxes
Division of Mining
Misc. Land Use Permits
Field Compliance Technical Assistance
DNR Lands Parks Forestry
Water Rights
Access Rights
Misc. Land Use Permits
OMB Division of Governmental Coordination
Coastal Districts
Coastal Zone Consistency Determination
U.S. Forest Service
U.S. Park Service
U.S. Bureau of Land Management
Notice or Approved Plan of Operation
Field Inspections, Reclamation
U.S. Army Corps of Engineers
Wetlands Permit
Compliance Inspection
EXPLANATION
Agencies
Permits, Authorization
Compliance Information

ADNR Division of Mining 3-8-88

Appendix B-1, Methodology for Forecasting the Future Number of Mines and Roads, and Acres of Reclamation and Disturbance

The number of expected future placer miners is difficult to calculate because of regulatory uncertainty; that is, standards may be so strict as to force many operators out of business, or the cost of compliance so high that the current price of gold precludes new investments. On the other hand, improved mining techniques and equipment may encourage miners to employ these increased capabilities. Therefore, it is believed that a good measure to estimate the number of future miners is to relate the number of miners to the price of gold.

As the price of gold increases or decreases the number of miners will increase or decrease accordingly. The EIS team developed relationships utilizing a one-to-one correspondence relating the price of gold to the number of miners.

Using these estimates, we reasonably expect that by 1998, the price of gold will be in the $600 per oz. range. This is a 23% increase over the highest 1987 price of $475 per oz. It is the expectation of this team that this also constitutes the worst- case scenario projecting over the next ten years. The following calculations were made to arrive at the expected future projections.

1. The 1981 acres disturbed was calculated from air photos.

2. The data for mines in 1987 were calculated from Alaska Placer Mining Applications and field knowledge of the BLM inspectors.

3. Estimations for 1998 were made by projecting that the price of gold would go up 23% by 1998.

4. The total number of miners in 1987 was calculated from Alaska Placer Mining Applications, and State Mineral Industry reports, and is the basis for projections of the number of miners in the future.

5. The proportional number of miners was calculated from the existing number of miners in each of the affected drainages, and included federal, State, and private operators.

6. Trends were extrapolated based on the existing operations.

7. Alternative futures were recalculated using a reduction factor in the 1987 EPA Economic Impact Analysis of Effluent Limitations report. In Table VIII-3 and VIII-4 of this report the EPA estimates that under various water quality standard options, a reduction of income will occur. This report concluded that for the small and medium operator the income reduction would range between 13% and 27%. If this is so, then we estimate that for Alternative A and B approximately 13% of the miners would not be able to afford the added cost of compliance, and for Alternative C approximately 27% of the miners could not afford the cost. For Alternative D, no federal miner would operate at any cost.

8. Roads and trails were calculated by air photos, field inspections, and map analysis. The 1987 data is divided into federal, State, and joint components.

9. The projections for 1998 are estimated as follows: Current federal roads will exist and will be increased by 40% to account for new mining roads and reuse of existing mining roads. All trails will be converted to roads and counted as such. Additional trails will be developed for new mines. Roads and trails are reduced by the same 13% and 27% as discussed above to account for less mining because of water quality restrictions. Special notes are indicated for each drainage.

10. Acres of disturbance are calculated using an estimated 50-foot road width and a 30-foot trail width.

11. Mine disturbances are estimated at five acres in the first year, two additional acres in the second year, two additional areas in the third year and two additional acres of reclamation the third year. At the end of ten years we estimate that 23 acres of land will be disturbed, with 14 acres being reclaimed and total reclamation occurring at the end of the mine life for mines on federal claims. Federal, State, and private mines would be reclaimed on this schedule for Alternative C.

Appendix B-2, Assumptions for Worst Case Scenario

The Worst Case Scenario was analyzed using the same assumptions considered for analyzing the Proposed Action in Chapter Four, with the following exceptions:

Fact

- There are about 1,350 active federal claims
- There are about 1,036 active State claims
- There are about 100 patented claims

Assumptions

- All federal claims would be mined and reclaimed within the next ten years.
- All State and patented claims would be mined within next ten years with no reclamation standards.
- Ten acres would be mined on each claim.
- The Proposed Action performance standards would be used and met on federal claims.
- There would be 250 active mines per years (135 federal mines, 115 State and patented mines).
- Ten acres would be mined per year.
- 2,500 acres would be mined per year.
- There would be ten acres reclaimed per federal mine annually beginning in the second year (1,350 acres reclaimed in years two through nine and 2,700 acres in year ten).

- There would be approximately 25,000 acres disturbed directly by mining activity during the ten year period.
- Roads and trails would be built to all active claims.

Appendix B-3, Methodology for Estimating the Administrative Cost of BLM's Surface Management Program and the Cost for Implementing Alternative D for the Birch Creek Drainage

The Steese/White Mountains District processed over 100 placer mining applications and inspected about 75 active mines during fiscal year 1987. For administrative cost estimation purposes, the cost of this program for fiscal year 1987 (approximately $175,000) has been divided into two parts, processing mining applications and field compliance, and has been used as the predictive model for this EIS. Considering the number of placer mining plans and notices processed, the amount of monitoring, and the compliance inspections completed, it was estimated that placer mining applications cost about $1,000 to receive, review, and process, (which includes conferring with applicants and preparing Environmental Assessments) and about $800 to inspect each active mine. The inspection costs include transportation, per diem, two monitoring visits, two inspection trips to the mine site, and preparation time for the compliance report. Both costs include between 10 and 15% overhead for management direction and training.

Administration of the Surface Management program for the Proposed Action would be a continuation of the program as administrated by the Steese/White Mountains District in Fiscal Year 1987. The estimated costs for processing a placer mining application and completing compliance inspections under the Proposed Action would be $1,000 and $800, respectively, for a total of $1,800 per mine.

Alternative A would place less emphasis on reclamation standards than does the Proposed Action, so it was assumed that the lower reclamation standards would require fewer mine site inspections to ensure compliance and would result in an estimated 50% reduction in cost of compliance. Therefore, the costs for processing a placer mining application and completing compliance inspections under Alternative A would be $1,000 and $400, respectively, for a total of $1,400 per mine.

Alternative B would place greater emphasis on reclamation standards than Alternative A and proposes a greater level of compliance inspection than the Proposed Action to ensure compliance with customary and proficient mining practices and reclamation performance standards; therefore, a 50% increase in inspection costs was estimated. The greater level of compliance inspection could include increased inspector training or a higher frequency of inspections. The costs for processing a placer mining application and completing compliance inspections under Alternative B would be $1,000 and $1,200, respectively, for a total of $2,200 per mine.

Alternative C would require more stringent performance standards than the other alternatives, so a 100% increase in compliance cost of the Proposed Action was estimated to be necessary to ensure compliance with these strict standards. An increase in BLM compliance cost would be attributed to additional inspector training, and a greater number of compliance inspections and some additional costs are attributed to the COE for the enforcement of reclamation standards. The costs for processing a placer mining application and completing compliance inspections under Alternative C would be $1,000 and $1,600, respectively, for a total of $2,600 per mine.

Validity examinations would be conducted on all properly filed mining claims (roughly 1350 claims in the Birch Creek drainage) and appraisals would be completed on all valid claims (all claims were assumed to be valid) in Alternative D. Conducting and completing validity examinations and appraisals were estimated to cost about $2,000 per claim, or approximately $2,700,000 for evaluating all of the claims in the Birch Creek drainage. The $2,000 claim evaluation cost was based on actual expenditures for similar evaluations conducted on Nome Creek in the nearby Beaver Creek watershed, during the summer of 1987.

The net present value (NPV) of each claim was estimated by discounting minimum and maximum claim values over a 10 year period using a 10% discount rate. The minimum and maximum claim values were estimated by making the following assumptions:

Minimum Claim Value

- Net pay gravel thickness was three feet
- Ten acres of each claim contained gold-bearing gravel
- Minimum pay gravel value was $4 per cubic yard
- Claim was mined out sometime within the next ten years
- A 10% profit for the mining operation was realized

Maximum Claim Value

Net pay gravel thickness was nine feet

Ten acres of each claim contained gold-bearing gravel

Maximum pay gravel value was $15 per cubic yard

Claim was mined out sometime within next ten years

A 25% profit for the mining operation was realized

Using these minimum and maximum claim value assumptions, the gross values of gold mined would be approximately $194,000 and $2,178,000 respectively. Since the timing of the mining activity was unknown, the profit from the mining operation was spread equally over a ten-year period. This cash flow was then discounted at an annual rate of 10% to determine the NPV. The NPV for the minimum claim values would be about $12,000 and the maximum claim value would be about $335,000. The minimum and maximum NPVs for all 1350 claims in the Birch Creek drainage are $16,200,000 and $452,250,000, respectively. This simplistic approach to determining NPV values was developed to present the magnitude of values that could be expected if the BLM selected Alternative D. The estimated claim values may not include the extreme minimum and maximum values that could exist on some claims.

Appendix B-4, Economic Worst-Case Scenario

The analysis of the "worst-case scenario" assumed that the total number of mines within the watershed would increase from 65 to 250 (385%) over the next decade. (See Appendix B-2 for the basis of this assumption). If so, it is reasonable to also assume that mining expenditures, total output, mining employment, total employment, mining income, and total income would also increase by about 385%. The economic impacts would be most significant in the local communities of Central and Circle Hot Springs. Total employment in Fairbanks would increase by less than 2%, but total income would increase by up to 10%.

Local population in and around Central and Circle Hot Springs could be expected to increase by 500 people (assuming that 21% of the additional miners would reside within the drainage or in nearby communities and the population would increase by three individuals for each additional miner. This significant increase in community populations would cause equally significant increases in demands for public/community services.

CENTRAL
WARNING!
NOTICE

A small social gathering in the early days at Central. Photo courtesy of Anchorage Museum of History and Art.

Appendix C-1, Geologic Time Scale

GEOLOGIC TIME SCALE

Era	System or Time Period	Series (rocks) or Epoch (time)	Approximate Age in millions of years (beginning of unit)
Cenozoic	Quaternary	Holocene	0.01
		Pleistocene	1.7 to 2.0
	Tertiary	Pliocene	5 to 6
		Miocene	25 to 27
		Oligocene	37 to 39
		Eocene	53 to 54
		Paleocene	63
Mesozoic	Cretaceous		136 to 138
	Jurassic		190 to 195
	Triassic		225
Paleozoic	Permian		270 to 280
	Carboniferous		345 to 350
	Pennsylvanian		
	Mississippian		
	Devonian		395 to 420
	Silurian		440 to 450
	Ordovician		ca. 500
	Cambrian		ca. 570
Precambrian			

Source: from Principles of Geology. 1975; Gilluly, James [and others]; San Francisco, CA; W.H. Freeman and Company; page 77.

Appendix C-2, Recreation Methodology

The concept of the value of river recreation use is based on the economics of consumer demand. A detailed examination can be found in "Wild and Scenic River Economics: Recreation Use and Preservation Values" by the American Wilderness Alliance. They indicate that three methods recommended by an interagency committee of the U.S. Government provide acceptable economic measures of the value of recreation (Water Resource Council 1979, 1983). The three methods were travel cost, contingent valuation, and unit day. In the above report, the unit day value was found most satisfactory.

In this method the U.S. Water Resources Council (WRC 1982) recommended a range of values from $6.10-$17.90 per day of specialized recreation. They included as criteria for rating specialized recreation: 1) quality of the recreation experience as affected by congestion, 2) availability of substitute areas within (x) hours of travel, 3) carrying capacity as determined by levels of activity development, 4) accessibility as affected by roads and parking conditions and, 5) environmental quality, including forest, air, water, pests, climate, adjacent areas, and scenery.

The WRC values are comparable to the calculations of outdoor recreation unit day values recommended by the Forest Service, Rocky Mountain Region, 1985. BLM recreation visitor use data (Alaska State Office) are used to estimate the total visitor values. Although specific Alaska recreation costs may be higher, the present valuation is an adequate tool for computing computing expected values.

The data is calculated basin-wide and needs to be viewed in that context when estimating the value of water-based recreation on the Wild and Scenic Rivers. The following is background information for recreation statistics:

1. Visitor use statistics are collected and reported by Districts for specific Special Recreation Management Areas (SRMS).

   This EIS is in AK08004 Steese NCA/Birch Creek 1,220,000 acres

2. Visitor use statistics supplied for Recreation Management Information System for this area generally have a reliability factor of "three", or low validity based on "best guess." Some statistics have a "two", or medium validity, which is based partially on primary or secondary sources and on reliable observations..

3. This methodology is only "best guess of reported visitor use."

4. Growth of the visitor use would not change based on a yearly rate, but site-specific growth would be created by other management actions such as, improvement of the turbidity of the water could increase visitor use or increase visitor information, such as brochures, news articles, etc. would increase awareness and visitor use.

   Use will increase without these actions, but each management action which improves access, provides facilities, or promotes use through visitor information, will increase use over and above any straight percentage figure.

5. Other Recreation Value. In addition to the recreation values indicated above, it is commonly accepted that "nonuse preservation values" of river values should be added to the total economic benefits of rivers to society. Studies such as "W&S River Economics, Colorado" determined that the general population may be willing to pay for the preservation of unique natural environments, and that their option, existence, and bequest values should be added to the unit day value, which is being estimated.

   In this EIS, it is impossible to determine these nonuse values, since analysis is an involved process evaluating the river values and characteristics in a regional approach by State and federal river managers.

6. Records of visitor use, expressed in visitor days, can be gathered from a variety of sources to evaluate use trends for the SNCA's primary attractor, Birch Creek NWR. A visitor day is defined as the equivalent of a 12-hour visit within the particular unit. The visitor day constitutes the presence of a person on a recreation area or site for the purpose of engaging in recreation activities during continuous, intermittent, or simultaneous periods of time aggregating 12 hours.

For sake of comparison, 1,000 visitor days would be counted for 20 parties of five persons floating down Birch Creek for five full days.

20 parties x five people/party x 10 visitor day periods = 1,000

In this case 100 people would be credited for 1,000 visitor days participating in the primary activity of floating. However, 1,000 visitor days would be also counted for 2,000 parties of two persons hunting in SNCA for three hours each.

2,000 parties of two people/party x 0.25 visitor day period = 1,000

In this case 1,000 visitor days would be credited to 4,000 people participating in the primary activity of hunting.

D-1 Landcover Methodology

Analysis of acreages affected by mining and reclamation were based on projected disturbance from mining and associated mining access roads and trails (Figure 4-2).

1. Acreages for pre-1981 disturbance were interpreted from NASA high-altitude aerial photos taken from 1978 through 1981. The acreages correspond with figures for tailings given in Wolff and Thomas (1982) for Livengood and Crooked Creek. The aerial extent of disturbance interpreted from the photos probably underestimates total disturbance since the acreages were calculated from areas that still show evidence of tailings piles and barren ground.

2. Figures taken from 1987 APMAs show that approximately 50% of mining disturbance on federal claims in the Birch Creek watershed was on old tailings, and 50% on new, previously unworked ground.

3. Mining disturbance on new ground is estimated to result in a 60% vegetation cover after reclamation and regrowth, with 40% remaining barren.

4. Mining disturbance on new ground which is not reclaimed is estimated to result in 75% barren, with a 25% vegetated cover after approximately 40 years. Washplant tailings have a greater proportion of fine-grained materials than tailings.

5. Disturbed areas on tailings would be extensively reclaimed with Alternative C. The addition of fine materials, fertilizer, and possible seeding would increase vegetative cover after regrowth. This level of reclamation is estimated to result in 50% vegetative cover, with 50% remaining barren.

6. Roads are assumed to remain barren, while trails are considered to be changed in vegetative cover and composition, but not rendered barren.

7. Total acreages for each alternative were calculated by adding historic disturbance, projected disturbance with associated regrowth for each alternative, and the contribution from roads or trails. Estimates for acreages for all alternatives are in Figure 4-2.

Appendix D-2, Recommended Mitigation Measures for Wildlife

Guidelines for development of measures to mitigate impacts to wildlife resources included prioritization of the types of mitigation. The highest priority was to avoid the impact, a lesser priority was to minimize or rectify the impacts, and last priority was to replace the impacted resource. On-site or in-basin mitigation within the stream or drainage where the impact occurred was favored, as was "In-kind" mitigation, where the impacted species would be replaced by the same species thereby reducing potential disruptions to the system's ecology and harvest management problems.

The type of management control or mitigation required for any impact depends on the type and extent of the impact, and the magnitude of the effects. Therefore, each impact needs to be well defined before specific mitigation measures can be identified. Based on identification of the impacts, expected short-term (5-10 years), continuous or long-term (up to 20 years or beyond), and unpredictable impacts are the types that will require mitigation. Potential measures suitable for mitigating short-term and continuous or long-term impacts resulting from the distinct components of the Proposed Action and alternatives are presented in the figure in this appendix. The potential mitigating measures listed for each mining action component are technically feasible and are considered appropriate for the anticipated magnitude of impact.

In order to provide an appropriate level of mitigation for any impact, the extent and magnitude of the impact effects on the wildlife resource must be known. Figure D-2a in this appendix summarizes expected impacts and provides an estimate of effects on the wildlife resources. In some cases, impacts cannot be precisely estimated due to their complexity, lack of information, or the low probability of their occurrence. Additional information is then required to develop suitable mitigation. In those instances, the potential impacts will need to be measured through an impact monitoring program designed to detect changes in biological and/or physical parameters. Changes that exceed some maximum acceptable level or threshold (as determined by the regulatory agency or agencies) would trigger a mitigation response plan. This plan can be developed for expected short-term impacts, continuous or long-term impacts, as well as potential impacts. A monitoring program could be implemented to 1) more accurately determine the impacts to the present and potential future population of a species, 2) determine timing, extent and duration of habitat(s) lost, 3) evaluate the effectiveness of habitat replacement or reclamation, and 4) determine the need for possible modification of previous management decisions. This long-term wildlife/mining impact monitoring program would be conducted cooperatively by BLM and ADF&G to provide information regarding the effects of mineral development activities, adequacy of mitigative measures (i.e. reclamation) and accuracy of impact predictions.

The timing and location of unpredictable impacts, such as a hazardous material spill, are unknown, so a monitoring program is not feasible. However, implementation of a pre-determined mitigation response plan to contain, neutralize, and clean up the impacted area is possible. A follow-up assessment of biological impact, reclamation, and replacement could then be implemented. The Alaska Department of Environmental Conservation has prepared a hazardous material spill contingency plan.

When specific mineral development actions are proposed in the area, a site-specific analysis of effects will be developed through the environmental assessment process, as required by the National Environmental Policy Act and the Surface Management Regulations (43 CFR 3809). As a result of this process, restriction or alteration of timing, location and extent of a mineral development activity may be required to avoid or minimize adverse effects and/or to avoid unnecessary or undue degradation. Possible crucial habitats, and timeframes, regarding which surface or aerial use restrictions may be required by BLM, are listed in Table 9-1 and 9-2 of the Record of Decision for the Resource Management Plan for the Steese National Conservation Area (DOI 1986).

Mitigative measures to replace/reclaim habitat that has been altered, removed, or lost as a result of mineral development activities are an inherent part of the Proposed Action and each Alternative (Section 2.5). Measures can be incorporated into the restoration techniques required in order to enhance the recovery process of wildlife habitat. For example, materials can be sorted as part of the mining operation, with larger materials deposited in the lower reaches of tailings and smaller materials above. This is especially important in previously mined tailings where there is no layer of overburden and top soil. Durst (1984) found that revegetation will be enhanced if the reconfiguration effectively reduces the slope of tailings, and reduces the height of tailings above the water table. In addition, plants will colonize more readily if reconfiguring leaves a "patchy" landscape that includes low wet spots with gentle slopes and hummocks. In cases where topsoil and/or fines are very limited, better results may generally be obtained by spreading these materials in a patchy manner than by evenly spreading them over only part of the area to be reclaimed. The varying degrees and effectiveness of the reclamation efforts required by the Proposed Action and each alternative have been incorporated into the analysis and are discussed in their respective sections (see Sections 4.6.1- 4.6.5). The success of reclamation varies from site to site and depends on elevation, aspect, slope, soil, water, and many other factors.

Mineral development action component	Habitat impact	Potential effect	Potential mitigating measure	Effectiveness
ACCESS				
Construction of permanent gravel roads	Habitat loss	Reduction in numbers	– Locate crucial use areas – Plan road alignments to avoid crucial areas	Would avoid or minimize loss of crucial habitat
Use of roads/trails	Disturbance/ disruption	– Alter habitat use – Increased harvest	– Locate crucial use areas – Plan trail alignments to avoid crucial areas – Restrict or alter timing, location & extent of activity – Monitor use of roads/trails – Monitor human use conflicts in crucial habitats – Monitor human use of wildlife resources – Coordinate with ADF&G	– Would avoid or minimize disturbance/disruption of wildlife use areas – Would provide information about effects, effectiveness of mitigation & accuracy of impact predictions – Would keep ADF&G informed
Potential upgrading & more roads/trails	Increase in habitat loss, disturbance/ disruption	Increase in above potential effects	– Locate crucial use areas – Plan trail alignments to avoid crucial areas – Restrict or alter timing, location & extent of activity – Monitor use of roads/trails – Monitor human use conflicts in crucial habitats – Monitor human use of wildlife resources – Coordinate with ADF&G	– Would avoid or minimize disturbance/disruption of wildlife use areas – Would provide information about effects, effectiveness of mitigation & accuracy of impact predictions – Would keep ADF&G informed
FACILITIES				
Construction of gravel pads, etc.	Habitat loss	Reduction in numbers	– Locate crucial use areas – Plan facility locations to avoid crucial habitats – Reclaim/replace lost habitat (see below)	– Would avoid or minimize loss of most crucial habitat – Would replace wildlife habitat in 5 – 50 years (see below)
Human habitation of facilities	Disturbance/ disruption	Alter habitat use	– Restrict or alter timing, location & extent of activity – Monitor human use conflicts in crucial habitats	– Would avoid or minimize disruption in crucial habitats
Solid waste disposal	Remove nuisance animals	Reduction in numbers	– Dispose of garbage & other waste in a manner to not attract wildlife – Comply with ADEC solid waste disposal regulations	Would avoid or minimize attraction of bears & other wildlife
OPERATIONS				
Stripping, mine cuts, stockpiles, settling basins	Habitat loss	Reduction in numbers	– Locate crucial habitats – Plan operations actions to avoid crucial habitats – Monitor overall habitat losses – Monitor reclamation effectiveness	– Would avoid or minimize loss of some crucial habitats – Would provide information about effectiveness of mitigation & accuracy of impact predictions

CONTINUATION

Mineral development action component	Habitat impact	Potential effect	Potential mitigating measure	Effectiveness
OPERATIONS cont'd				
Stripping, mine cuts, stockpiles, settling basins	Habitat loss	Reduction in numbers	– Reclaim by recontouring, respreading fines & topsoil, fertilize &/or reseed &/or replant willows[1] – Reclaim by recontouring, respreading available topsoil, natural succession[2] – Reclaim by stabilizing to prevent erosion, natural succession[3] – Reclaim by recontouring, respreading fines & topsoil, natural succession[4] – Reclaim by recontouring, respreading fines, fertilize &/or reseed with native plants (no shrubs)[5]	– Would replace habitat in 5 – 25 years[1] – Would replace habitat in 50 years – Would replace habitat in 50 years – Would replace habitat in 30 – 50 years – Would replace habitat in 25 – 35 years
Operation of machinery	Disturbance/ disruption	Alter habitat use	– Restrict or alter timing, location & extent of activity – Monitor operations disturbance/disruption in crucial habitats	– Would avoid or minimize disturbance/disruption in crucial habitats
Fuel spills Hazardous materials	Habitat loss	Reduction in numbers	– Response plan to contain, neutralize & clean up – Comply with ADEC hazardous materials regulations	– Would avoid or minimize size, extent & duration of habitat loss

[1] Source: Sisk, unpublished data

[2] Specified in Proposed Action and Alternative D

[3] Specified in Alternative A

[4] Specified in Alternative B

[5] Specified in Alternative C

Figure D – 2(a). General effects of mineral development actions and their potential mitigation measures.

	Management Objective	Standards	Reference
I. Birch Creek and Tributaries in River Corridor			
A. National Wild River System	Preserve river in its natural and free flowing condition.		Wild and Scenic River Act (P.L. 90-542) ANILCA (P.L. 96-487).
B. Water Resources 1. Water Quantity 2. Water Quality	Protect water quality and quantity.	Federal Reserved Water Rights. State Water Quality Standards.	Birch Creek River Management Plan (Dec.83) SNCA ROD (Feb. 86);FEIS 75-15 Birch Cr. (Dec. 74)
C. Primitive Recreation Resources 1. Float boating 2. Fishing	Provide high quality primitive recreation opportunities for present and future generations.	Visitor Days NTE:2,200 (FEIS-75-15) Recreation Opportunity Spectrum: Primitive setting: Essentially unmodified natural environment evidence of humans would be unnoticed by an observer, rare. Social setting usually less than 6 parties/day encountered.	Birch Creek RMP (Dec.83) SNCA ROD (Feb. 86) FEIS 75-15 Birch Creek (Dec. 74)
II. River Corridor Above High Mean Water			
A. National Wild River System	Preserve river's immediate environment in its natural, primitive condition.	Federal Register Notice	Birch Cr. RMP(Dec. 83); SNCA ROD (Feb. 86); FEIS 75-15 Birch Cr. (Dec.74); PL 90 - 542; PL 96-487
B. Visual Resources		VRM Class I	Birch Cr. RMP (Dec. 1983); ROD (Feb. 86)
C. Primitive Recreation Resources 1. Camping 2. Hunting 3. Wildlife Viewing 4. Other Compatible Recreation Uses	Provide high quality primitive recreation opportuntities for present and future generations. Provide a variety of opportuntities for interpretative scientific, educational, and wildland oriented uses.	Visitor Days NTE:8,500 (FEIS 75-15) Recreation Opportunity Spectrum:Primitive Setting: Essentially unmodified natural environment, evidence of humans would be unnoticed by an observer, structures are rare. Social setting: Less than 3 parties visible at campsite.	Birch Cr. RMP (Dec. 83)
III. Steese National Conservation Area (within EIS area, but outside of Birch Creek corridor)			
A. National Conservation System Unit	Establish a program of multiple use and sustained yield and for the maintenance of environmental quality.		ANILCA (PL 96-487); ROD.(Feb. 86)
B. Water Resources 1. Water quality drainages north and south of Birch Creek	Maintain state water quality standards for currently clear flowing tributaries.	State Water Quality Standards	ROD (Feb. 86)
C. Visual Resources	Protect existing viewshed along Birch Creek NWR.	VRM Class II - "Critical Viewshed" VRM Class II - Remainder	ROD RMP(Feb. 86)
D. Semi-Primitive Recreation Resources 1. Hunting 2. Fishing 3. Wildlife viewing 4. Camping 5. Off-road vehicle	*Provide semi-primitive opportunties for quality hunting, trapping, fishing, wildlife viewing and ORV use more compatible with fish, wildlife and other recreation uses. Improve access to recreation opportunties.	Visitor Days NTE: Not established. Recreation Opportunity Spectrum:SPM;SPNM. Setting: Natural setting may have moderately dominant alterations but would not draw the attention of motorized observers on trails and primitive roads. Structures are rare and isolated. Special setting: Low to moderate contact frequency.	SNCA ROD (Feb. 86)

	Access Component	Facility Component	Operations Component
I. Birch Creek and Tribututaries in River Corridor			
A. National Wild River System			
B. Water Resources 1. Water Quantity 2. Water Quality	Quantity: No Effect. Quality: Development of roads and trails maintenance and/or lack of proper maintenance may adversely affect water quality.	Facilities, camps on main stem could adversely affect water quality. Water quanity: No effect: No diversions on wild rivers.	No effect: As long as no operations on river. Quality: Operations off river may affect river quality.
C. Primitive Recreation Resources 1. Float Boating 2. Fishing	Improved access will increase recreation use on river, may exceed carrying capacity by concentrating use at access points. Setting may be modified if improved roads/trails reach river. Social setting may exceed ROS primitive standards.	Facilities, camps on main stem would have impact on quality fishing.	No likely affect: No operations in corridor.
II. River Corridor above High Mean Water			
A. National Wild River System	Roads not allowed in "wild" river segments.	Camps not allowed in wild river segments.	No effect.
B. Visual Resources	Potential long term impact from "trails" crossing wild river.	Camps not allowed.	No effect.
C. Primitive Recreation Resources 1. Camping 2. Hunting 3. Wildlife Viewing 4. Other Compatible Recreation Uses	Improved access will increase recreation use in river corridor concentrated at access points; may exceed carrying capacity. Setting may be modified if improved roads/trails/enter corridor. Social setting may exceed ROS primitive standards.	Facilities, camps on main stem would detract from primitive setting and social setting. Would modify environment. Would increase social encounters.	Operations likely to affect wildlife pattern in region *see Wildlife.
III. Steese National Conservation Area (within EIS area, but outside of Birch Cr. Corridor)			
A. National Conservation System Unit	Only access developed in environmentally sound manner permitted.	Only facilities developed in environmentally sound manner permitted.	Only environmental sound operations permitted in NCA.
B. Water Resources 1. Water quality drainages north and south of Birch Creek	Quality on "south" side: Development of trails, maintenance and/or lack of proper maintenanc may affect water quality. Quality on "north" side is same as above.	Facilities camps could have adverse affect on water quality; hazardous wastes.	Adverse affect likely *see Hydrology. No effect if state water quality standards enforced.
C. Visual Resources	Road and development in viewshed would affect Class II VRM areas.	No development in "critical viewshed" Potential adverse affect.	Potential adverse affect.
D. Semi-Primitive Recreation Resources 1. Hunting 2. Fishing 3. Wildlife Viewing 4. Camping 5. Off-Road Vehicle	Northside of Birch Cr: Semi-primitive setting and social setting cannot be met near roads and major trails. Southside of Birch Cr: No effect.	North of Birch Cr: Social setting and semi-primitive setting cannot be met near concentrations of facility developments. South of Birch Cr: No effect.	North of Birch Cr: Semi-primitive standard cannot be met in areas in concentrations of mining claims. Quality hunting, fishing, and wildlife view not likely (see wildlife). South of Birch Cr: Semi-primitive setting likely to be maintained.

Appendix E-1, Methodology for Sediment

In 1973, the EPA estimated the various erosion rates from various land uses. While this data is based on nationwide rates and does not specifically represent Alaska, it does provide a set of parameters that can be used as a comparison. This comparison focuses on the relative contribution of ongoing and historic placer operations; proposed future contributions may thereby be placed in perspective.

One of the reasons for using this type of methodology is the issue of data. In theory, it is possible to calculate the sediment that can be put into a stream and predict the amount that will pass by a point downstream. In practice, such a task is difficult, requiring a considerable amount of sediment, hydraulic, and hydrologic data. More specifically, the types of soils, ground cover, slope and aspect, nature of the operation, microclimate precipitation, and a host of other variables suggest that an overall approach be developed for comparative purposes. Such data are not available for the enjoined watersheds, except for some limited data, especially on Birch Creek (ADEC 1986). The EIS team developed their own approach using the EPA data, then compared it to the Birch Creek data:

1) EPA (1973) estimated the representative rates of erosion from various land uses, in annual tons per square mile to be:

Forest	24
Abandoned surface mines	2,400
Harvested forest	12,000
Active surface mines	48,000
Construction	48,000

2) EPA methodology does not identify the relative contributions to water courses or normal sediment traps.

3) Acreage figures were used from ongoing and projected disturbances and converted to a square mile ratio.

4) Representative rates and areas were multiplied to get suggested comparative rates.

5) Some specific assumptions were made, which in the final analysis means that our projections probably overstate the actual magnitude of the problem. The assumptions include:

a. Forest lands are estimated to be 90% of the basin, and forest cover is defined as all covered ground.

b. No regrowth and regeneration occur on previously disturbed lands.

c. Disturbances continue past 1998 but reclamation will occur at the end of the mining operation.

d. Construction of roads and other development will contribute less sediment on successive years, but this progressive decline is not calculated here.

6. Figure 3-1 is a summary of this evaluation.

7. When compared to Birch Creek (ADEC 1986) the following generalizations can be made:

a. The average estimated sediment load for two undisturbed basins (Boulder Creek - 30.47 square miles and Bedrock Creek - 10.35 square miles) was 0.0010 and 0.0038 tons per hour per square mile, respectively. If these rates are projected to the entire Birch Creek drainage, and figured on a 24-hour day and a 200-day season, the projected sediment rates are 11,234.6 and 42,774.1 tons per 200-day season. This is compared to our idealized sediment from forests of 46,224 tons per year.

b. The average estimated sediment load for Birch Creek at the Steese Highway (which includes all mined areas) was 0.014 tons per hour per square mile during the 1985 field season. For projection purposes, all things being equal, using the Dames and Moore (ADEC 1986) study, the BLM would estimate that, based on a 200-day season, about 143,800 tons of sediment would find its way past the bridge monitoring station. The idealized sediment rates were calculated to be 202,820 tons per year. So the BLM estimates, in a very general qualitative way, are within about 30% of the calculated values of the Dames and Moore study.

8. Tons of sediment per year and tons of sediment for an Alaska 200-day season are converted to tons per day.

Appendix E-2, Staking and Operating a Federal Mining Claim

The following paragraphs tell how to locate a Federal mining claim and what the BLM's requirements are for operation on a claim.

A certain degree of background research is necessary to identify what general area a prospective miner may be interested in. The interested party must identify where, by legal land description, he/she intends to conduct activities. Examination of a 1:2,500,000 (E series) map will aid in the proper identification of BLM lands and, when used in conjunction with the master title (MT) plats found in the public room, will help identify lands open to mineral entry. Proper identification and marking of the prospect on a topographic map to more clearly define the area of interest will aid the proponent in finding the lands of interest in the field.

After determining where the desired location is, the proponent must travel to the actual site and determine if any location markers exist. If not, the claim must be "located" by establishing clearly visible location posts or markers and then recording the claim with the proper authorities, i.e., the State of Alaska's Recording Office and the BLM (of course, a prospective miner can take a chance and not go through the process of claim location, but he/she then runs the risk of having someone else staking (locating and recording) the claim and being legally able to force them off the claim.) Once a claim is properly located and recorded, $100 worth of assessment work must be performed on the claim every year with proof of the work performed filed by December 30th annually with the BLM. If this is not accomplished and the claimant desires to keep his/her claim, he/she must file with the BLM by December 30th annually a Notice of Intent to Hold.

While it is to the advantage of any prospective miner to legally locate and file his/her claim there is no requirement that a miner must do so prior to conducting mining activities.

The filing of a Notice, as per 43 CFR 3809.1-3, is required of any operator (other than casual use operators or recreational miners as described in 43 CFR 3809.1.2) whose facilities disturb 5 or less acres. A Notice filing must include the name and mailing address of the mining claimant and operator, if other than the claimant; when applicable, the name of the mining claim(s); a statement describing the activities proposed and their location in sufficient detail to locate the activities on the ground; the approximate date of the onset of the activities; a description of the access routes to be constructed; a description of the equipment to be used; a statement that all reclamation of disturbed areas will be accomplished in accordance with 43 CFR 3809.1-3(d); and a statement that reasonable measures will be taken to prevent unnecessary or undue degradation of the Federal lands. No recommended format for the Notice exists. (This portion may be under judicial review by the District Court).

The filing and approval of a Plan of Operations, as per 43 CFR 3908.1-4, is required of any operator whose facilities disturb more than 5 acres. A Plan filing must include the above listed information as well as a map, preferably topographic, showing existing or proposed routes of access, aircraft landing areas, or other means of access, and size of each area where surface disturbance will occur; and measures to be taken during extended periods of non-operation to maintain the area in a clean and safe manner and to reclaim the land to avoid erosion and other adverse impacts.

BLM may do the following things to ensure compliance with the reclamation of mining sites: [see other agency permits (Chapter One)]

- Conduct field compliance inspections/monitoring
- Develop reclamation plans with the operator/claimant
- Develop mitigative measures/site specific stipulations
- Require mandatory bonding
- Seek court intervention
- a. Temporary restraining order
- b. Injunction from further activity

- Institute fines or civil penalties
- Perform reclamation, and go to court to recover costs from the operator/claimant

Appendix E-3, Comparison of Reclamation Requirements and Estimated Costs

Reclamation Requirements				
Proposed Action	**Alternative A**	**Alternative B**	**Alternative C**	**Alternative D**
Grade tails, stabilize soils, stabilize streams, bypass	Grade tails, stabilize soils, stabilize streams,	Grade tails, spread soils, overcontour tails stabilize stream bypass	Reseed and fertilize, reestablish stream channel	No mining, post-1981 unreclaimed, ground to follow Alt. A standards

Cost Per Acre in 1987 Dollars				
Proposed Action	**Alternative A**	**Alternative B**	**Alternative C**	**Alternative D**
$500-tailings $500-soils	$500-tailings	$500-tailings $500-soils	$500-tailings $500-soils $250-fertilizer $100-seed $350-stream	$500-tailings
$1,000 total	$500 total	$1,000 total	$1,700 total	$500 total

Comparison of reclamation requirements and estimated costs. Sources: Reclamation Research Plans for Alaska National Park System Units, 1986; Alaska Department of Natural Resources, Division of Mining; Bureau of Land Management estimates.

Appendix F-1, Regulatory Program of the U.S. Army Corps of Engineers, Alaska District

The U.S. Army Corps of Engineers (COE) is the federal permitting agency for work proposed in waters and wetlands. Within the State of Alaska, this program is administered by the U.S. Army Engineer District, Alaska.

As its primary regulatory responsibilities, the COE has jurisdiction over the construction of any structure in or over navigable or tidally influenced waters, the excavation of material from navigable waters, the obstruction or alteration of navigable waters, and the placement of dredged or fill material into waters of the United States, including wetlands.

Work proposed in navigable waters of the United States is subject to Section 10 of the Rivers and Harbors Act of 1899. This Act requires a Department of the Army (DA) permit be obtained prior to performance of any construction or activity that alters the course, current, condition, or navigable capacity of a navigable water.

Work proposed in waters of the United States is subject to the Clean Water Act. Section 301 of the Act requires that a DA permit be obtained prior to the placement of dredged or fill material into waters, including wetlands. Permit specifications are identified in Section 404.

Within the Birch Creek, Beaver Creek, and Fortymile River drainages, no navigable waters subject to Section 10 of the Rivers and Harbors Act of 1899 are present. However, extensive areas subject to Section 404 of the Clean Water Act are present. Within the Minto Flats drainage,certain waters have been designated navigable by the COE and are subject to Section 10 of the Rivers and Harbors Act of 1899. Like the other drainages, extensive areas within the purview of the Minto Flats Environmental Impact Statement (EIS)are subject to Section 404 of the Clean Water Act.

The regulations implementing the COE's permit program are found at 33 CFR 320 et seq. As identified in the regulations the COE's mandate is to consider the public interest when determining whether proposed work should be authorized. No work shall be permitted unless it is found to be in the public interest. Further, waters of the United States and a regulated activity are not restricted by land ownership. A COE permit may be required for work proposed on private land as well as for work proposed on public land.

If a proposed project is located in an area subject to COE jurisdiction and requires issuance of a permit, a formal application must be submitted. A public notice describing the proposed work would be prepared and issued to other federal, State, and local agencies and to members of the public for review and comment. If the project is controversial, a public hearing may also be held. In addition to review of the proposed project by other agencies and individuals, the COE conducts its own public interest review.

The decision whether to issue a permit will be based on an evaluation of the probable impacts, including the cumulative impacts, of the proposed activity and its intended use on the public interest. The benefits which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. All factors which may be relevant to the proposal must be considered including the cumulative effects thereof. Among the factors considered are conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, land use, navigation, safety, and the needs and welfare of the people among others.

As a result of the public interest review, proposed work may be authorized, denied, or issued with special conditions. Additionally, an applicant may be requested to modify potentially detrimental aspects of the proposed work to comply with the intent of the Clean Water Act or to other laws that apply to the review process. A schematic presentation of the COE's permit application review process is shown in Figure F-1.

In addition to issuance of individual permits, proposed work may also be issued by existing Nationwide permits found in the COE regulations, by General Permit (GP), or by Abbreviated Processing Procedures (APP). In its review of proposed placer mining work, the Alaska District is presently identifying those projects not subject to COE authority, those projects subject to COE authority and authorized under Nationwide Permit, and those projects suitable for review under individual permit application review procedures. A GP for placer mining is also being considered and may be in use by late spring, 1988. In addition, an APP is being developed but is not anticipated to be in effect for the 1988 mining season. Once in place, however, those projects meeting the terms and conditions of either procedure could receive expedited processing.

Though not considered to be an inclusive list, many of the activities associated with placer mining subject to COE authority are identified below. Additional information on work subject to COE authority may be found in the COE's regulations.

For the COE, preparation of BLM's EISs will provide analysis and documentation from which future COE authorization of work proposed in the areas subject to the EIS would be tiered. Under individual permit application review procedures, project specific environmental assessments may be tiered from each EIS. In addition to the analysis and discussion of anticipated impacts contained in each EIS, the particular circumstances of each project, including analysis of site-specific impacts, would be included in the environmental assessment prepared for each project. Second, development of GPs for work proposed in areas subject to EIS preparation could be tiered from each EIS. Third, APP could be tiered from the subject EISs.

For projects being reviewed under individual permit application review procedures or under APP, the COE will also evaluate each project under the Section 404(b)(1) Guidelines prepared jointly by the COE and the EPA (40 CFR Part 230). In addition to determining whether the proposed work meets standards established by the Guidelines, the Section 404(b)(1) analysis includes a review of project alternatives in an effort to avoid or minimize anticipated adverse impacts to aquatic values. For works authorized under a GP, a Section 404(b)(1) analysis would be prepared for all work anticipated to be authorized under each GP. Section 404(b)(1) analysis of each project would not be prepared.

The COE's Regulatory Branch will assist any individual, agency, company, or corporation in determining whether issuance of a permit for proposed work is required. More detailed information concerning the COE regulatory program, including information concerning the regulation of activities associated with placer mining, may be obtained by writing to the COE at the following address:

Regulatory Branch
Alaska District
U.S. Army Corps of Engineers
P.O. Box 898
Anchorage, Alaska 99506-0898
or by telephoning (907) 753-2712 or toll free at (800) 478-2712.

Activities Subject to Section 404 of the Clean Water Act

The following activities associated with placer mining are subject to Section 404 of the Clean Water Act when performed in waters of the United States, including wetlands:

1. the stockpiling of overburden;

2. the stockpiling of placer bearing material prior to processing;

3. the placement of dredged and/or fill material associated with work such as stream diversions, reservoirs, impoundments, and fish bypass channels; and dams, dikes, and berms related to water diversion, collection, and/or retention;

4. the placement of dredged and/or fill material associated with construction of roads, i.e., roads accessing the mine as well as roads located within the mined area(s). NOTE: Nationwide Permit Number 14 may apply for minor stream crossings;

5. the placement of dredged and/or fill material associated with the construction of settling basins, including the construction of access roads, berms, dikes, and similar works;

6. the placement of dredged and/or fill material associated with the excavation of bedrock drains, drainage ditches, and similar works;

7. the placement of dredged and/or fill material associated with the construction of buildings, staging areas, equipment facilities, airstrips, and similar works; and

8. the placement of dredged and/or fill material associated with reclamation.

Activities Subject to Section 10 of the Rivers and Harbors Act of 1899

The following activities associated with placer mining are subject to Section 10 of the Rivers and Harbors Act of 1899 when performed in navigable waters of the United States:

1. all activities listed under work subject to Section 404 of the Clean Water Act above;

2. dredging; and

3. any other activity in, on, or over a navigable water that could affect the course, current, condition, or navigable capacity of a navigable water.

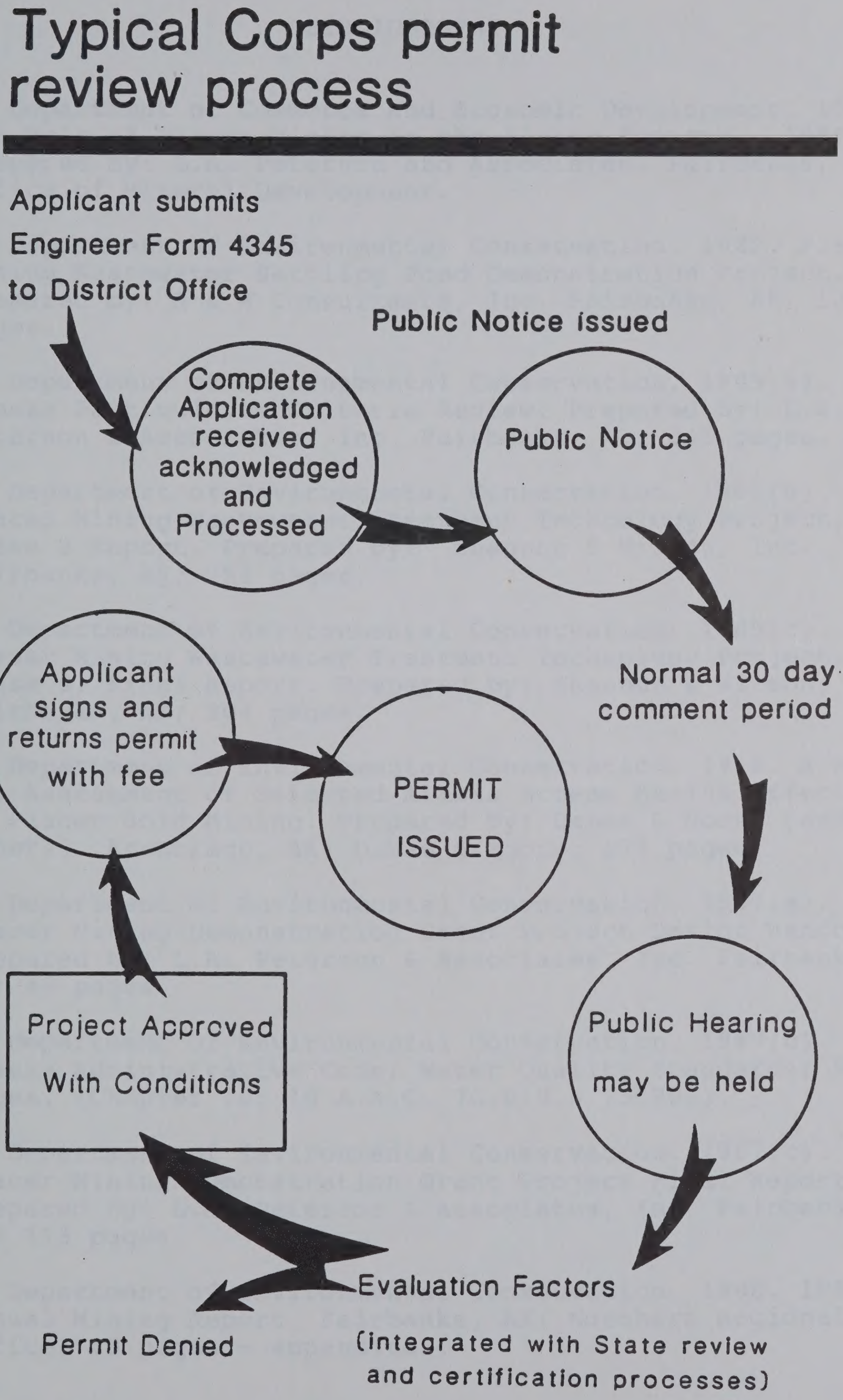

Typical Corps permit review process
Applicant submits Engineer Form 4345 to District Office
Complete Application received acknowledged and Processed
Public Notice issued
Public Notice
Normal 30 day comment period
Public Hearing may be held
Evaluation Factors (integrated with State review and certification processes)
Permit Denied
Project Approved With Conditions
Applicant signs and returns permit with fee
PERMIT ISSUED

Figure F-1. Permit Review Process.

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Glossary

Active Mining Claim: A current BLM mining claim in which all assessment and other requirements have been met, although no active mining may be taking place.

Alevius: A newly hatched salmon with yolk sac still attached.

Allochthonous: Formed elsewhere and transported from a distance.

Alluvial fan: A low, outspread mass of loose rock material shaped like an open fan deposited by a stream at the place where it issues.

Alluvium: Deposits laid down by modern rivers and streams.

Anadromous: Aquatic organism migrating from marine waters to freshwater to spawn.

Alteration Zone: An area being modified or changed in any noticeable way.

Aquifer: A body of rock that is sufficiently permeable to convey ground water and to yield economically significant quantities of water to wells and springs.

Areal: A multi-leveled or spatial relationship between two or more resources.

Aspect: A particular status or phase in which something appears or may be regarded.

Association: In an abstract sense, a group of communities or stands that are classified together because they meet certain standards of similarity.

Aufesis: An ice feature formed by water overflowing onto a surface, such as river ice or gravel deposits, and freezing.

Batholith: A large plutonic mass that has more than 40 square miles of surface exposure and no known floor.

Benthic: Relating to or occurring at the bottom of a water body.

Biomass: Amount of living matter as in a unit area or volume of matter.

Biotite: A general term to designate all iron and magnesium- bearing micas.

Braided Stream: A stream flowing in several dividing and reuniting channels resembling the strands of a braid. Typically within a wide floodplain.

Bryophytes: Non-flowering plants comprising of the mosses and liverworts.

Burin: A steel tool with an oblique point and rounded handle for carving stone, or a prehistoric chisel-like flint tool.

Candidate Species: Those species (plant or animal) included in the Federal Register "Notice of Review" listing that are being considered by the FWS for listing as threatened or endangered species.

Chaining: Cultivating implement used to spread and distribute debris; usually devised of link chains.

Channelize: A non-natural rerouting of a stream course.

Cirque: A deep, steep-walled, half-bowl-like recess situated high on the side of a mountain and commonly at the head of a glacial valley and produced by the erosive activity of a mountain glacier.

Classification: Separation of materials by size.

Clay: Sediment particles between 0.002 and 0.004 mm in equivalent spherical diameter.

Climax: A more or less stable biotic community which is in equilibrium with existing environmental conditions and which represents the terminal stage of an ecological succession.

Coagulation: A chemical process that reduces turbidity in a water body.

Code of Federal Regulations (CFR): Regulations promulgated and enforced by federal agencies which have the full force of law.

Coliforms: Relating to, resembling, or being a bacilli that resides in vertebrate intestines.

Colluvial: Soil material, rock fragments, or both, which have been deposited at the base of a steep slope by creep, slide, or local wash.

Comminute: To reduce to minute particles or pulverize.

Community: Any group of organisms belonging to a number of different species that co-occur in the same habitat or area and interact through trophic and spatial relationships, typically characterized by reference to one or more dominant species.

Critical Viewsheds: A unit within a National Wild River that has special considerations.

Crown Fire: A fire that burns mainly the top foliage of trees or shrubs.

Crustose: Having a thin thallus, adhering closely to a substratum of rock, bark, or soils.

Cryofibrist: An organic soil material (peat) formed under cold conditions.

Cryogenic: A soil formed under cold conditions, literally "cold genesis."

Cumulative Effects or Impacts: The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

D2: Refers to Section 17(d)2 of the Alaska Native Claims Settlement Act.

Deciduous: To fall off or shed annually, seasonally, or at a certain stage in the life cycle.

Dendritic: A stream pattern characterized by irregular branching in all directions.

Detritus: Material released by weathering processes and subsequently transported and deposited as sediments.

Dike: A tabular igneous intrusion that ducts across the structure of the surrounding rock.

Disclimax: An ecological succession maintained below climax by climatic instability, fire, grazing, or by the activities of man.

Ecosystem: The Community including all the component organisms together with the abiotic environment, forming an interacting system, e.g., a marsh.

Ecotone: The boundary or transitional zone between adjacent communities or biomes.

Endangered species: Any species which is in danger of extinction throughout all or a significant portion of its range due to current or planned activity. (The Endangered Species Act - Amendments of 1982).

Endemic: Native to or restrictive towards a particular type of habitat, locality, or region.

Environmental Assessment: This document is prepared for actions not exempt from NEPA, not categorically excluded, not adequately covered in an existing RMP/EIS or other environmental analysis, and not normally or obviously requiring an EIS.

Ericaceous: Refers to the heath family of plants. Heaths are dwarf woody shrubs, including such species as blueberries, cranberries, mossberries, etc.

Federal Land Policy and Management Act (FLPMA): BLM's "organic act" which serves as the basic law providing direction for lands and minerals management under its jurisdiction.

Federal Register: A publication system used to inform the public of Federal regulations, proposed regulations, and to provide for the publication of agency statements of organization, procedural rules, and general policy.

Felsic: An igneous rock containing light minerals such as quartz, feldspars, feldspathoids and muscovite.

Fingerling: A fish up to one year of age; between the fry and smolt stage.

Fines: The smaller-grained particles of soil or gravel, usually consisting of fine sand, silt, and clay.

Flaggy: A soil characterized by coarse rock fragments that are flat, thin, and angular, with dimensions of six to 15 inches.

Flocculation: A chemical process that causes clay particles to stick together, making them settle out faster and reduce turbidity.

Fluvial: Produced by river or other stream action.

Foliose Lichens: Lichens having a flat, thin, and usually lobed thallos attached to a foundation.

Forb: Any herbaceous plant which is not a grass or sedge.

43 CFR 3809: Regulations which set forth policies and procedures providing for mineral entry, exploration, location, operations and purchase pursuant to the mining laws in a manner that will not unduly hinder such activities, but will assure that these activities are conducted in a manner that will prevent unnecessary or undue degradation and provide protection of non- mineral resources of the Federal lands.

404 Permit: The 404 guidelines are the substantive criteria used in evaluating discharge of dredged or fill material under Section 404 of the Clean Water Act.

Freshet: A great rise or overflowing of a stream due to heavy rains or melting snow.

Frost Boil: A small area of upward movement of soil or inorganic material caused by the freezing and thawing of free water in the soil.

Fruiticose: More or less shrub-like.

Fry: A recently hatched fish that has used up the yolk cas, and has emerged from gravel and is ready to feed.

Gel Log: A chemical treatment that settles out suspended solids from effluent water before releasing it into a stream.

General Mining Law of 1872: Provides for exploration, development, production, and purchase of mineral resources of the public lands, as well as the implied right of statutory access to mining claims.

Giardia: Infestation or disease caused by a flagellate protozoan.

Graminoid: Refers to an herb with long, narrow leaves, i.e., grasses and sedges.

Gravimetric: Analysis which pertains to a measurement by weight.

Harrow: A cultivating implement with spikes, spring teeth, or discs, and used primarily for smoothing and distributing soil.

Herb: A plant with one or more stems that die back to the ground each year; grasses and Forbs as distinct from shrubs and trees.

Hydrology: The study of the origin, distribution, and properties of water on or near the surface of the earth.

Hydrostatic Pressure: Pressure exerted or transmitted by fluids at rest.

Ice Wedge: Wedge-shaped ground ice produced in permafrost, occurring as a sheet, dike, or vein tapering downward. It originates as the growth of frost or by the freezing of water in a narrow crack or fissure.

Invasion: The Migration and Establishment of an organism in a new location.

Karsting: An irregular limestone region with sinks, underground streams, and caverns.

Lacustrine: Pertaining to, produced by, or formed in a lake or lakes.

Legume: A plant belonging to the pea family (Leguminosae).

Listed Threatened and Endangered Species: A species (plant or animal) that is officially recognized by FWS as being threatened or endangered.

Lithic: A medium-grained sedimentary rock containing abundant fragments of previously formed rocks; also said of such fragments.

Loam: Soil material that is seven to 27% clay particles, 26 to 50% percent silt particles and less than 52% percent sand particles.

Lode: A vein containing important quantities of metallic ore and filling a well-defined fissure in the rock.

Mafic: Igneous rock composed chiefly of one or more dark iron and magnesium-bearing minerals.

Management Framework Plan: A planning decision document prepared before the effective date of regulations implementing land use planning provisions of FLPMA which provides interim management until replaced by the RMP.

Massif: A principal mountain mass.

Management Goal: Goals that have been developed through the planning processes of BLM and other agencies for the watersheds being considered.

Master Title Plats: Maps displaying lands status of lands managed by the federal government.

Megafauna: Living or fossil animals large enough to be seen with the naked eye.

Metasedimentary: Sediment or sedimentary rock that shows evidence of being subjected to physical and chemical conditions below the earth's surface.

Mineral Soil: Soil composed mainly of inorganic materials and with only a relatively low amount of organic material.

Mining Technique: Methods used by miners to operate their mine. This includes activities such as exploration, access, development, mineral extraction, and reclamation.

Moraine: 1) Solidified volcanic debris carried on the surface of a lava flow. 2) A mound, ridge or other distinct accumulation of glacial drift deposited chiefly by direct action of glacial ice.

Morphology: A branch of biology or paleontology that deals with the form and structure of animals and plants, or their fossil remains.

National Environmental Policy Act (NEPA): This Act establishes a national policy for the protection and enhancement of the environment. Federal agencies are directed to develop methods and procedures that ensure the unquantified environmental values are given appropriate consideration in decisionmaking as are economic and technical considerations.

National Recreation Area: A federally managed area which involves the protection, regulated use, and development of public lands for recreational enjoyment.

Native: Indigenous; living naturally within a given area; used of a plant species that occurs at least partly in natural habitats and is consistently associated with certain other species in these habitats.

Navigable Waters of the United States - (COE definition): Navigable waters of the United States are those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. A determination of navigability, once made, applies laterally over the entire surface of the waterbody, and is not extinguished by later actions or events which impede or destroy navigable capacity (33 CFR 329.4).

Non-Point Source: All turbidity, suspended sediment, and sedimentation resulting from soil erosion caused by human activity and emanating from a widespread area.

Notice: A Notice must be filed by all mining operators whose operations, including access across federal lands to their claim, cause a cumulative surface disturbance of five acres or less during any calendar year.

Notice of Intent: A public notice stating that an environmental impact statement will be prepared and considered.

Orographic: Relating to mountains, ie., precipitation caused by uplift of an air mass over a mountain range.

Oxbow Lakes: Remaining lakes that were once a part of a river channel, but are now isolated from the main stream. Most resemble a bent or U-type configuration.

Peltic: 1) Pertaining to or characteristic of pelite, a sedimentary rock composed of clay and minute particles of quartz. 2) A metamorphic rock derived from a pelite.

Physiography: Relating to the form of the earth or its surface features, e.g. topography.

Peraluminous: A type of igneous rock in which the molecular proportion of alumina exceeds that of soda, potash, and lime combined.

Performance Standards: A measurable quantity used to define the limits of allowable environmental impacts resulting from mining and related activities.

pH: The hydrogen-ion activity of a solution, which is an indication of the solution's acidity or basicity.

Physiography: Relating to the form of the earth or its surface features, e.g., topography.

Plan of Operations: This plan is required for mining operations disturbing five surface acres or more, and any operation except casual use in areas designated for potential addition to, or an actual part of the Wild and Scenic Rivers System, and designated areas of Critical Environment Concern, the National Wilderness Preservation System administered by BLM, and areas closed to off-road vehicle use.

Pluton: An igneous intrusion or rock mass formed within surrounding rock of another type.

Primary Succession: Succession beginning on a bare area, not previously occupied by plants or animals.

Propagule: Any part of an organism, produced sexually or asexually, that is capable of giving rise to a new individual.

Proposed Action: Any resource use or development or management action proposed by the Bureau, or to the Bureau by a member of the public, or by another agency through any appropriately developed procedures including, in the case of non-Bureau proposals, nominations, petitions, and applications.

Record of Decision: A brief statement which completes the associated EIS and, among other things, indicates which alternative, or combination of alternatives has been approved.

Recorded: The filing of paperwork with the State and BLM to make a mining claim properly of record.

Resource Management Plan: A land use plan as prescribed by the Federal Land Policy and Management Act which establishes: 1) the level and intensity of land use, 2) allowable resource uses and related levels of production or use, 3) resource condition goals and objectives, 4) program constraints and general management practices needed to achieve the above, 5) the need for an area to be covered by more detailed and specific plans, 6) support action to achieve the above, 7) general implementation sequences, and 8) intervals and standards for monitoring and evaluating the plan. It is not a final implementation decision on actions which require further specific plans, process steps, or decisions under specific provisions of law and regulations.

Riparian: Refers to land bordering a stream, lake, or tidewater.

Scarify: See harrow or chaining.

Scoping: The act of holding organized meetings to address significant issues that are of particular concern to individuals or groups.

Section 810: Section within ANILCA mandating that subsistence uses and needs are to be considered in federal land use decisions.

Sedge: A rush-like or grass-like plant that grows in wet places.

Sere: The series of stages that follow one another in an ecologic succession.

Serotinous: Refers to late opening, such as cones of black spruce trees which remain on the trees for several years without opening. Allows cones to survive fires, and provide seed source after fire.

Settling Pond: A pond, usually artificially constructed of tailings, designed to remove sediment from water by simple settling.

Settleable Solids: The volume of matter in water that will settle in one hour under quiescent conditions in an Imhoff cone.

Sierra Club Lawsuit: The series of orders and injunctions arising from the Sierra Club's action that resulted in this EIS.

Significance: A high degree of importance as indicated by either quantitative measurements or qualitative judgments. Significant issues and impacts require explicit consideration in preparing a plan. Significance may be determined by evaluating characteristics pertaining to location, extent, consequences, and duration. As used in the National Environmental Policy Act, "significance" requires consideration of both context and intensity. (see 40 CFR 1508.17)

Significant Restriction to Subsistence Uses and Needs: BLM policy states that a "significant restriction to subsistence uses and needs" could occur if there is: 1) a reduction in harvestable resources used for subsistence purposes, 2) there is a reduction in the availability of resources caused by an alteration in their distribution, migration, or location, or 3) a limitation on the access of subsistence users to harvestable resources. Generally, only the prediction of large or substantial effects as opposed to slight effects in one or more of these three categories would result in a section 810 evaluation of significant restriction to subsistence uses and needs.

Sill: A tabular igneous intrusion that parallels the structure of the surrounding rock.

Silt: Sediment particles between 0.004 and 0.0625 mm in equivalent spherical diameter; coarse mud.

Skarn: An old Swedish mining term for silicate waste rock with certain iron-ore and sulfide deposits.

Sluice: To mine or wash with water. Also used synonomously with sluicebox.

Sluicebox: The rectangular shaped launder, containing riffles, that is used as a gold recovery system in placer mining.

Solifluction Lobe: A mass of soil material which, because of water saturation, has formed a small terrace through the slow, mass movement of the soil blanket downslope.

Special Area: Those geographic areas, large or small, possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important or easily disrupted ecological values.

Stocks: An igneous intrusion that is smaller than a batholith and more or less circular in shape.

Stone Stripe: A form of patterned ground consisting of a line of rocks or other inorganic material parallel to the slope of the ground, caused by the freeze - thaw cycle and the effects of gravity.

Stratigraphy: The science or arrangement of rock strata.

Stream Bypass: A channel constructed to divert an active stream channel around a mining operation, so to avoid direct stream contact.

Strike-slip Fault: A fault on which the movement parallel to the fault's strike.

Subsistence Uses: Section 803 of ANILCA defines the term "subsistence uses" to mean "...the customary and traditional uses by rural Alaskan residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of nonedible by-products of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade." For the purposes of this definition, 1) "family" means all persons related by blood, marriage, or adoption, or any person living within the household on a permanent basis; and 2) "barter" means the exchange of fish or wildlife or their parts, taken for subsistence uses - (a) for other fish or game or their parts; or (b) for other food or for nonedible items other than money if the exchange is of a limited and noncommercial nature.

Succession: The replacement of one kind of community by another kind; the progressive changes in vegetation and in animal life which may culminate in the climax.

Sucker: In many plants, a shoot arising from the lower parts of the stem or from the root.

Suite: A collection of rock specimens from a single area, generally representing related igneous rocks.

Taiga: A swampy area of coniferous forest.

Tailings: Waste material processed through a placer operation usually consisting of coarse sand and larger particles.

Taxonomic: The study of the general principles of orderly scientific classification, usually according to their presumed natural characteristics.

Terrane: A rock or group of rocks and the area in which they crop out.

Threatened Species: Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range (The Endangered Species Act - Amendments of 1982).

Thrust Fault: A fault with a dip of 45° or less over much of its extent, on which the hanging wall appears to have moved upward relative to the footwall. Horizontal compression rather than vertical displacement is its characteristic feature.

Tiering: An interrelationship in which reference to a more general NEPA document such as an EIS can be made by a more specific one, thus avoiding duplication. Designed to focus on the actual issues ripe for decision at each level of environmental review.

Topsoil: The upper soil layer or layers containing some organic matter.

Tailrace: A channel in which mine tailings are carried away.

Tundra: The treeless land in arctic and alpine regions, varying from bare area to various types of vegetation consisting of grasses, sedges, forbs, dwarf shrubs, mosses, and lichens.

Turbidity: The condition of a body of water that contains suspended material such as clay or silt particles, dead organisms or their parts, or small living plants and animals.

Tussock: A dense, heavy tuft or matted growth of grass or sedge which forms a small hillock.

Type: A kind of vegetation, e.g., community-type, forest type, birch type.

Unnecessary or Undue Degradation: This is surface disturbance greater than what would normally result under a prudent operator in usual, customary, and proficient operations of similar character. Effects of operations on other resources and land uses, including resources and uses outside the area of operations are also considered.

Vegetation Type: A kind of vegetation or the kind of community of any size, rank, or stage of succession.

Vegetative Reproduction: Reproduction by asexual processes.

Visual Resource Management (VRM): Utilized to classify landscapes and visual characteristics. Classification I has a higher value than II and III.

Volatile Organics: Carbon-based line matter that is highly vulnerable to disruption.

Watershed: A region or area bounded peripherally by water, parting and draining ultimately to a particular watercourse or body of water.

Wetland: 1) An area of low-lying land, submerged or inundated periodically by fresh or saline water. 2) Wetlands have been defined by the COE in 33 CFR 323 as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."

Wild River: Those rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive, and waters unpolluted.

Windlass: A device for hauling or hoisting.

Zero Discharge: A condition where there is no effluent discharge from a mining operation.

Acronyms

ACEC........Area of Critical Environmental Concern

ADGGS.....Alaska Department of Geological and Geophysical Surveys

ADFG........Alaska Department of Fish and Game

ADNR........Alaska Department of Natural Resources

AHC...........Arctic Hydrologic Consultants

AHRS........Alaska Heritage Resources Survey

ANILCA....Alaska National Interest Lands Conservation Act

BLM..........Bureau of Land Management

CEQ..........Council on Environmental Quality

CFR...........Code of Federal Regulations

CFS...........Cubic Feet per Second

COE..........Corps of Engineers

DEC..........Department of Environmental Conservation (Alaska)

DOA..........Department of Agriculture

DOI...........Department of Interior

EIS.............Environmental Impact Statement

EPA...........Environmental Protection Agency

FLPMA.....Federal Land Policy and Management Act

ml/l............Milliliters per liter

NEPA........National Environmental Policy Act

NOI............Notice of Intent

NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Units
NWR	National Wild River
RMIS	Recreation Management Information System
RMP	Resource Management Plan
ROD	Record of Decision
SHPO	State Historic Preservation Officer
SNCA	Steese National Conservation Area
SRMS	Special Recreation Management Area
TSS	Total Suspended Solids
U.S.C	United States Code
USGS	United States Geological Survey
VRM	Visual Resource Management
WMNRA	White Mountains National Recreation Area
WRC	Water Resources Council
WRM	Wild River Mile
WSRA	Wild Scenic River Act

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